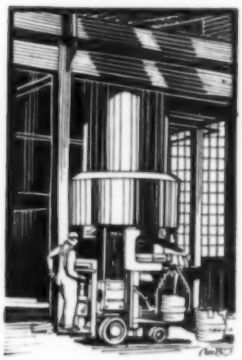
THE FOUNDRY

Established in 1892



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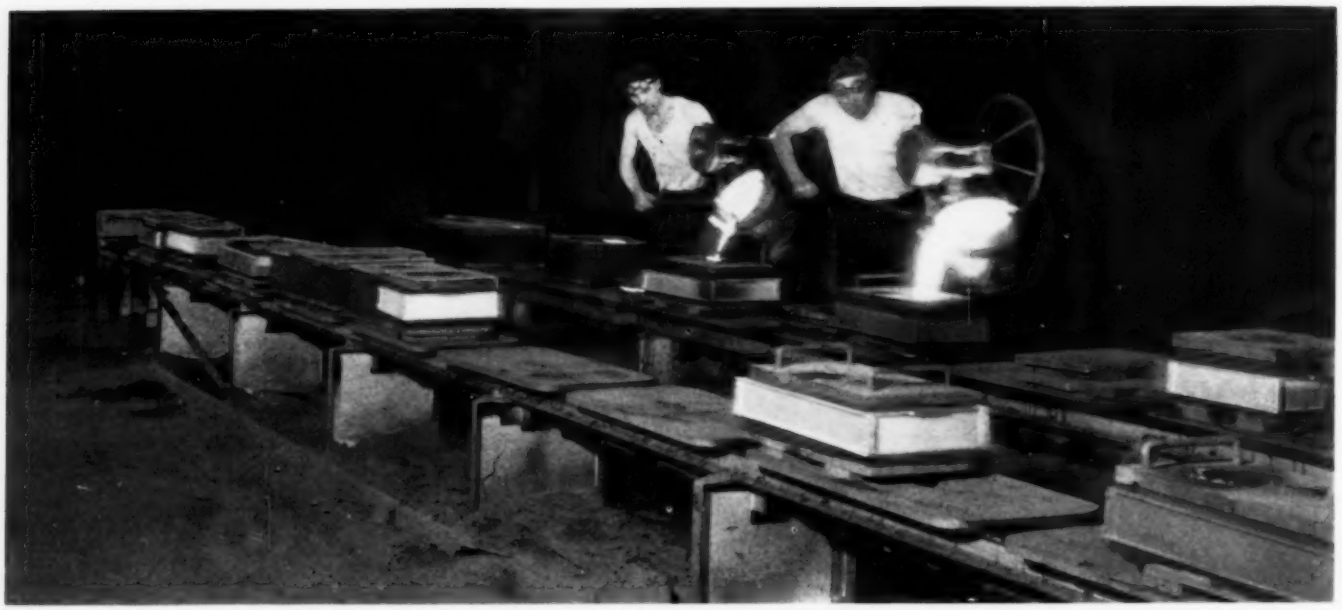
Continuous Pouring-

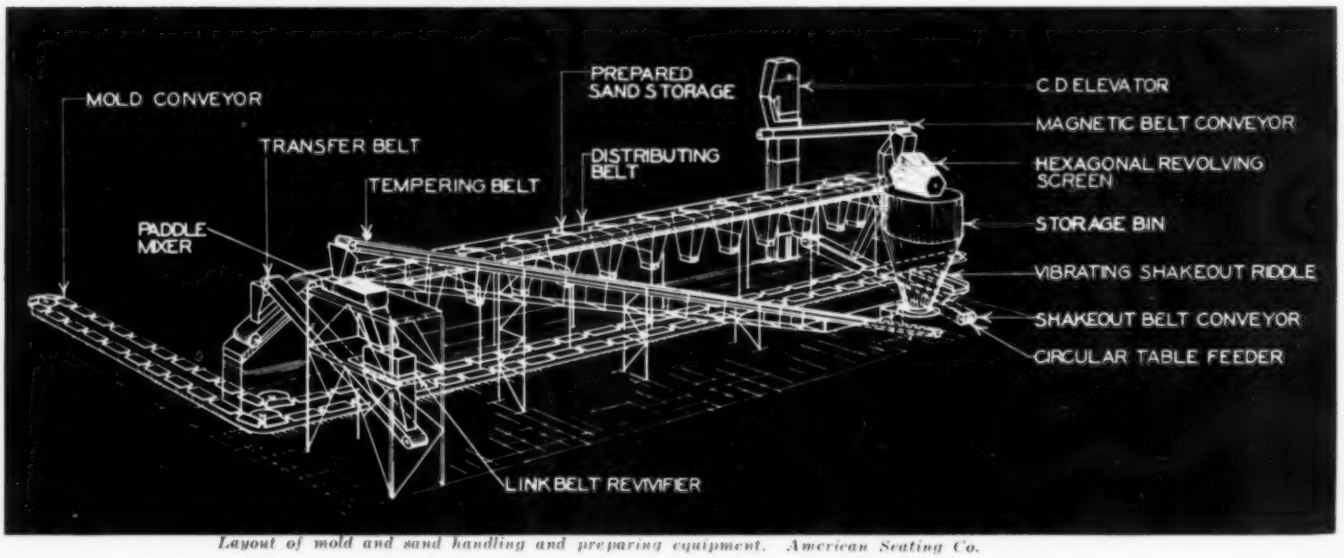


Pouring zone on a Link-Belt sliding type mold conveyor. Travels 27 ft per minute, allowing pouring of 2½ to 3 tons per hour. American Seating Co.

Careful application of equipment can give the benefits of "continuous process" production to many small as well as large foundries now operating with old-fashioned methods. The continuous system can usually be profitably installed in plants producing as low as 25 tons of castings per day.

The installation illustrated here—American Seating Co., Grand Rapids, Mich., affords a good example of a foundry of 25 tons per day capacity, where a marked decrease in the cost of castings has been attained.

Let Link-Belt help you plan to make savings in your own business. With foundry knowledge based on years of experience, and the best equipment that money can buy, Link-Belt engineers will see that you get a money-making installation, exactly suited to your individual needs.

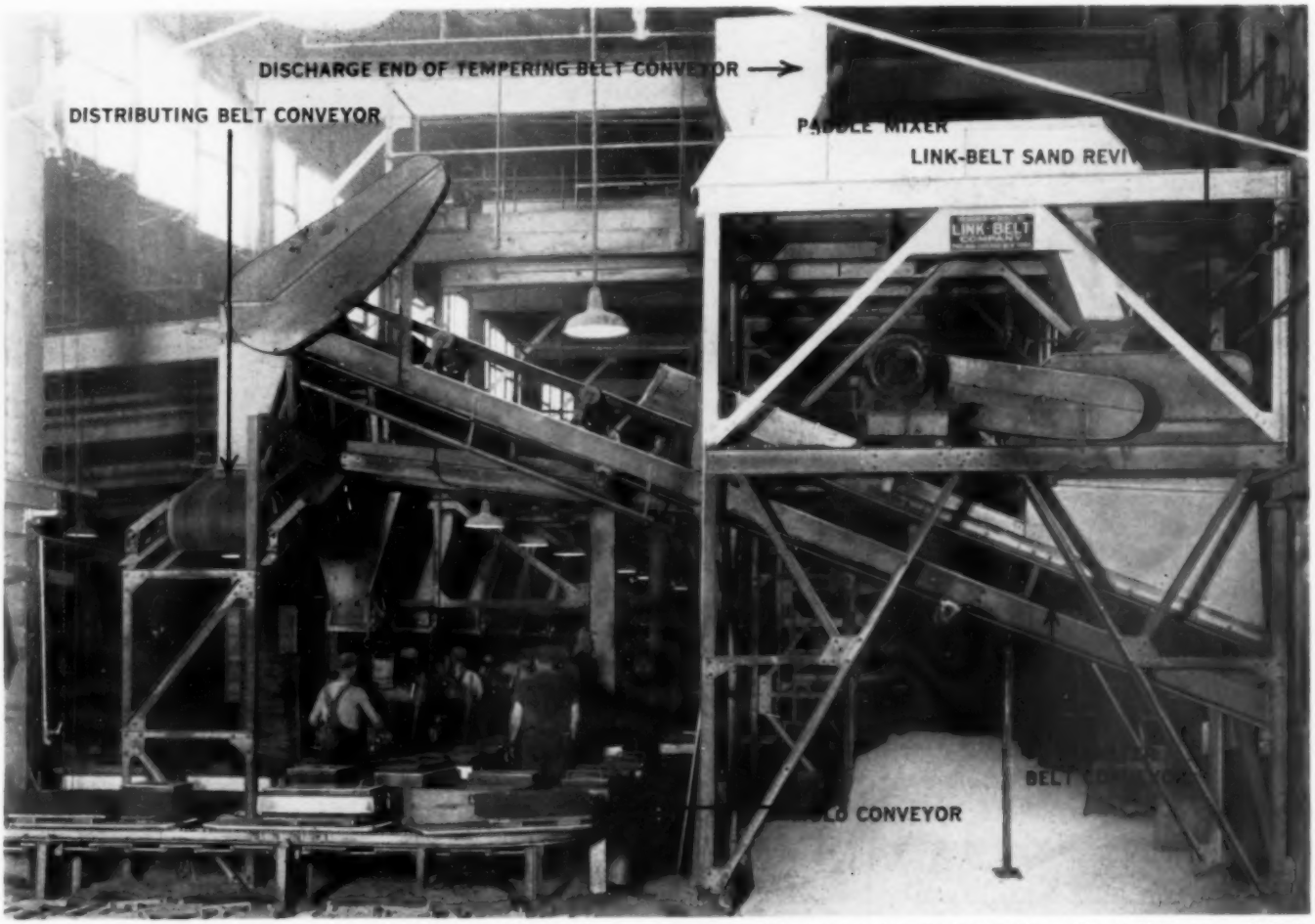


Layout of mold and sand handling and preparing equipment. American Seating Co.

LINK-BELT

SAND, MOLD, CASTINGS HANDLING EQUIPMENT

—When Does It Show Economies?



As the molds are completed they are placed on the traveling mold conveyor, and poured after passing the last molder. The castings are sufficiently cooled by the time they reach the shakeout riddle, and here the sand and castings are separated. The sand is carried by the shakeout belt conveyor to the elevator, and from the elevator to a magnetic belt conveyor, then through a revolving screen, and into the storage bins. From the bin the sand is fed out by an adjustable table feeder, to a tempering belt where water is added. It then passes through a paddle mixer and revivifier, from where a transfer belt to the distributor belt conveyor, puts it back into the prepared sand hoppers over the molding machines.

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Leading Manufacturers of Equipment for Handling Materials Mechanically and for the Positive Transmitting of Power

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300 W. Pershing Rd.

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2045 W. Hunting Park Ave.

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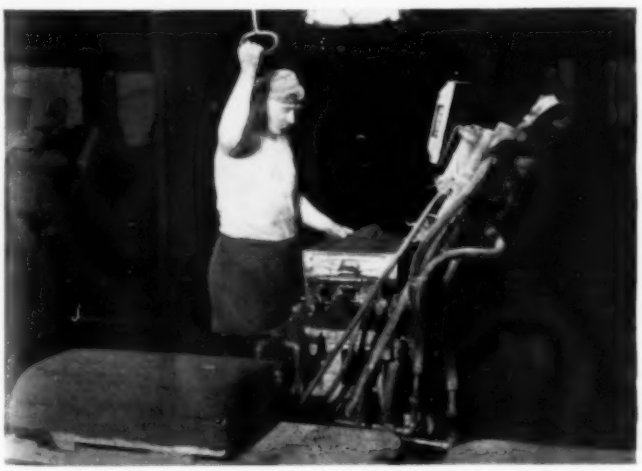

Molder's station shows convenience of sand supply (operator needs only pull handle); and of mold conveyor to put completed mold on. There is a complete elimination of walking and bending.

Gates and sprue are separated from the castings on this Link-Belt Vibrating shakeout riddle by the man shown here. The complete absence of smoke and steam at the shakeout is clearly shown.

IF IT'S A HERMAN IT'S WORTH USING. IT MADE ITS WAY BY THE WAY IT'S MADE

HERMAN MOLDING MACHINES

DOWN go molding costs—UP go savings

The new Hi-Speed HERMAN Jarr Rollover Machines are very rapid in operation and they are of heavy design to meet the requirements of modern production foundries.

Our service department will gladly advise you the type best suited for your work.

HERMAN PNEUMATIC MACHINE COMPANY

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See you at the A. F. A. Meeting in May at the Statler, Detroit
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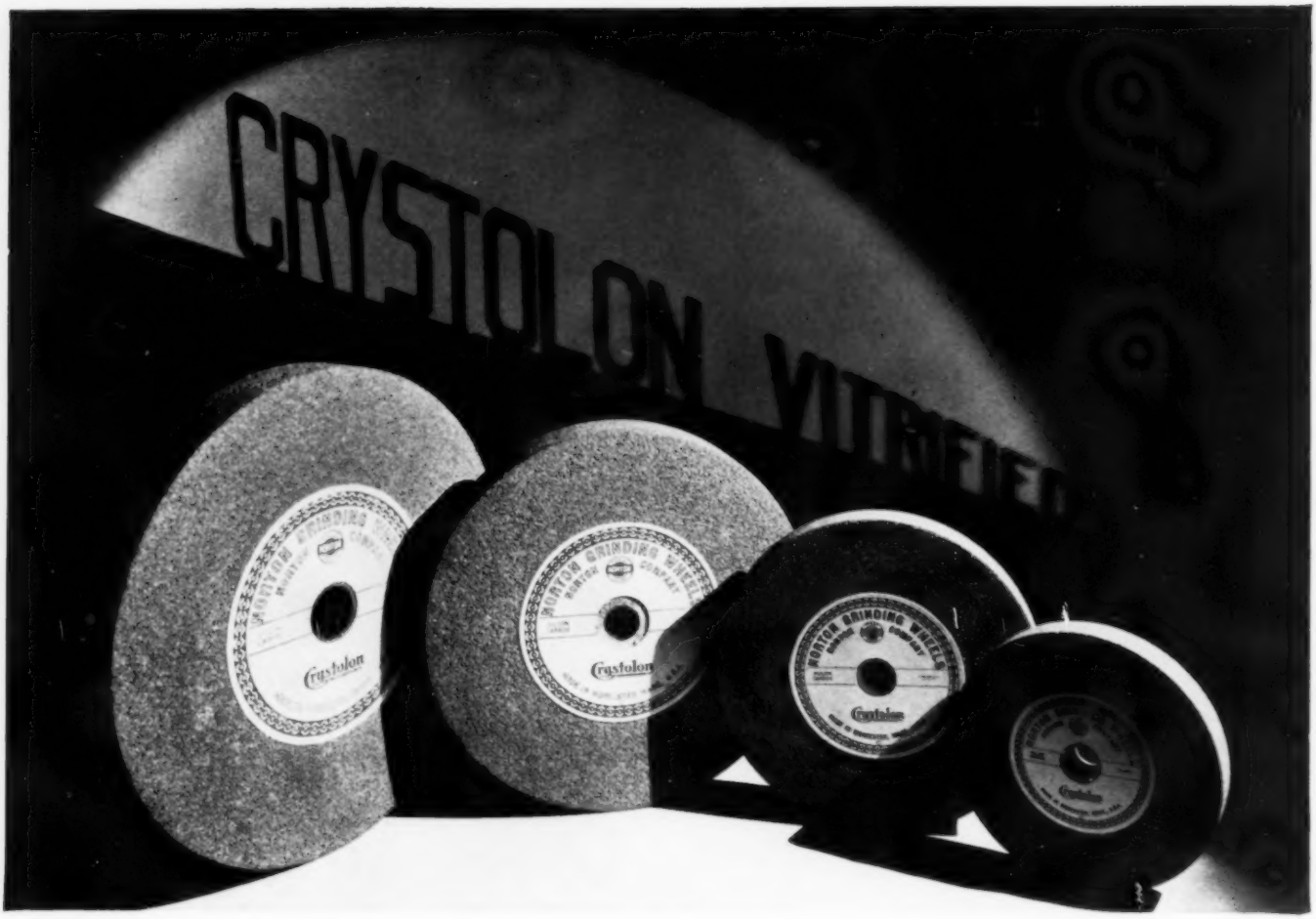

The Old "Stand-by" for Snagging Cast Iron

GREY iron castings are usually fairly smooth and have comparatively little metal to be removed. The advantages of high speed snagging are not so marked with them as with steel castings. Six thousand surface feet per minute is still the popular wheel speed.

And the Norton Crystolon vitrified is the popular wheel. Its fast, free cutting action and long life have been amply demonstrated—by many years of use in foundries the world over.

If you are snagging cast iron it will truly pay you to do it with Crystolon vitrified wheels. We'll be glad to recommend the most suitable grains and grades for your particular work.

NORTON GRINDING WHEELS

NORTON COMPANY, WORCESTER, MASS.

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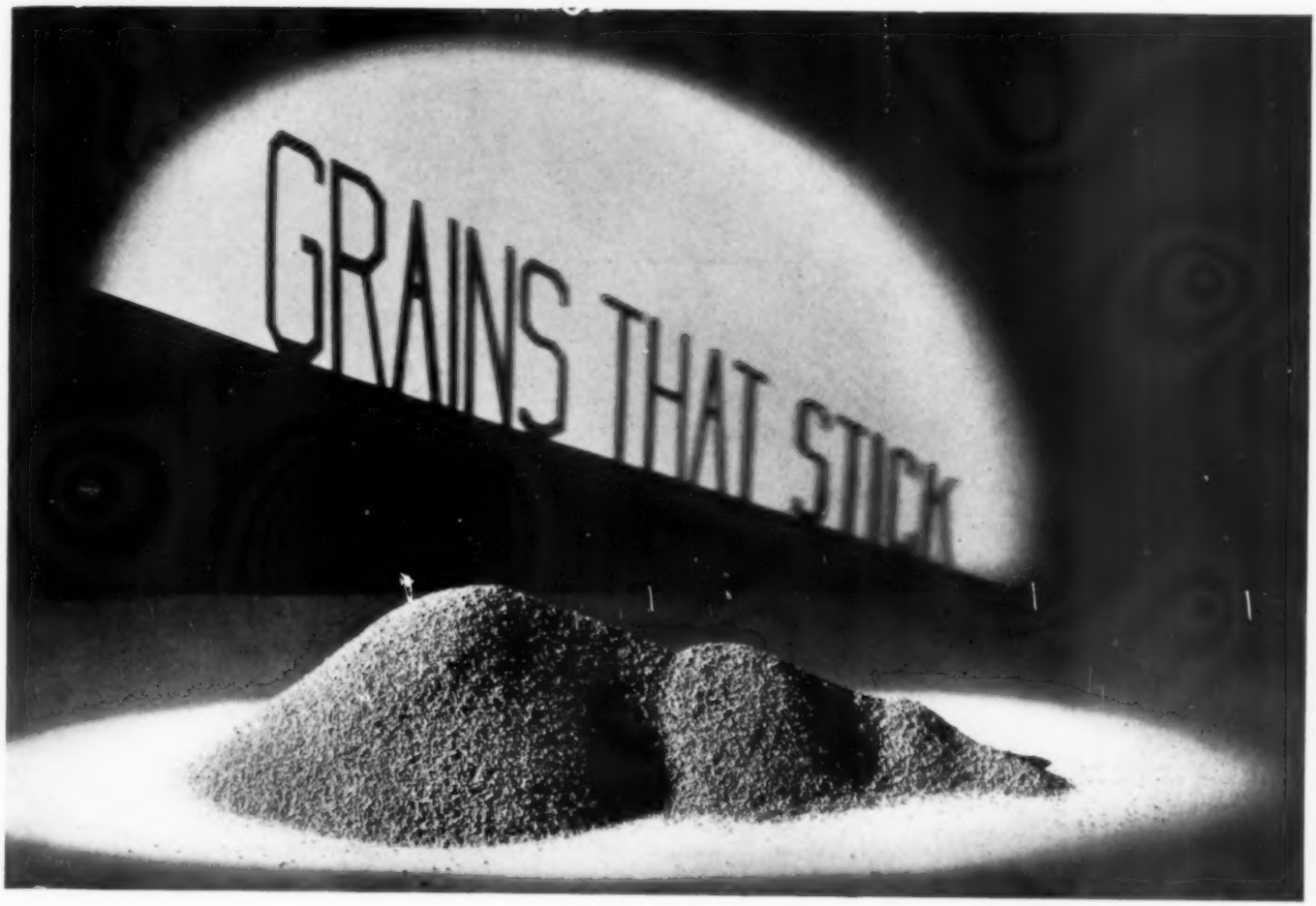
W399

NORTON PRODUCTS—Grinding Machines; Lapping Machines • Grinding Wheels; Abrasives for Polishing; India Oilstones, Pulpstones • Laboratory Ware, Refractories; Porous Plates • Non-slip Tiles and Aggregates



Properly Treated Alundum Abrasive

GRAINS of high capillarity; grains that bond firmly in glue; that make strong polishing wheel heads to withstand the rigorous demands of today's production.

For severe polishing conditions use Alundum "C" Abrasive; strong, rugged; the grain that in 94% of all trials, under all shop conditions has proved to be, on the average, 24% more economical than grain previously used.

For finer finishing, Alundum "B" Abrasive; specially treated to produce a grain that will prolong wheel life without sacrificing finish.

Our demonstrators, experienced polishers, will be glad to discuss your abrasive requirements with you.

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NORTON COMPANY, WORCESTER, MASS.

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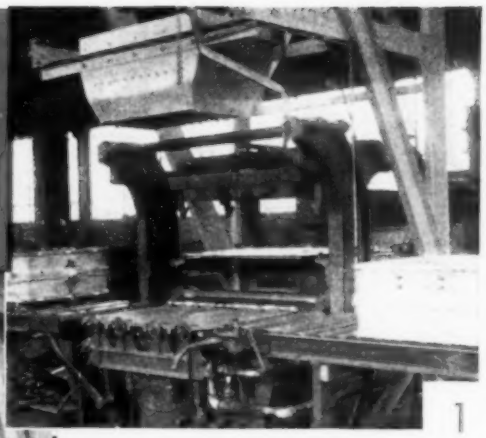
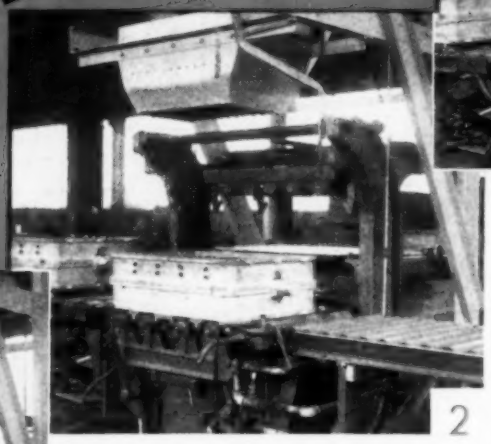
NORTON PRODUCTS — Grinding Machines; Lapping Machines • Grinding Wheels; Abrasives for Polishing; India Oilstones, Pulpstones • Laboratory Ware, Refractories; Porous Plates • Non-slip Tiles and Aggregates

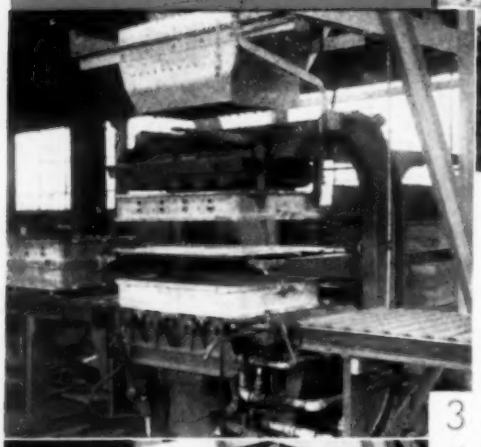
The 1002



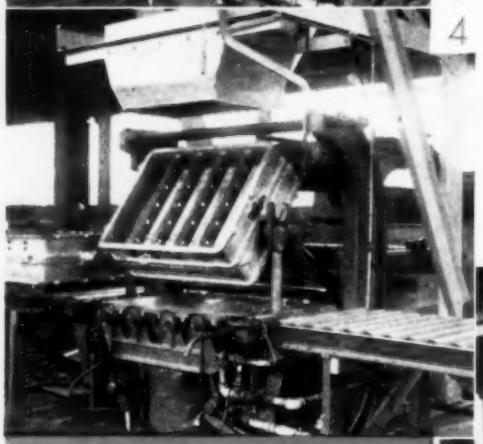
1 Empty flask at right . . . ready to start moulding operation.



2 Cope and drag flasks on machine.

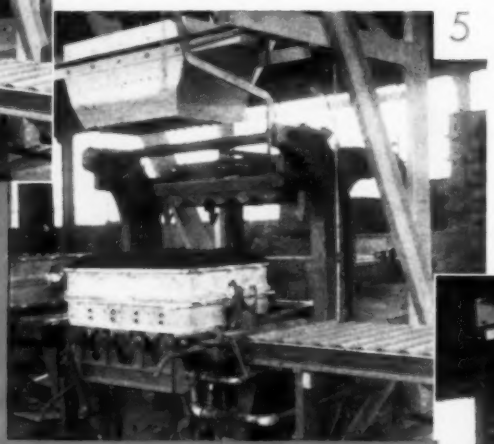


3 Flask separated and match plate inserted.



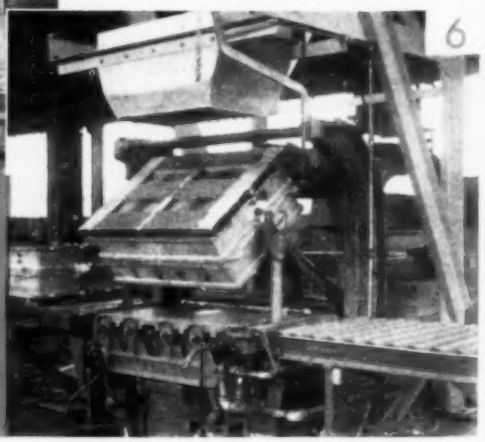
4 Cope, drag and match plate being rolled over.

5 Drag filled and jolted.



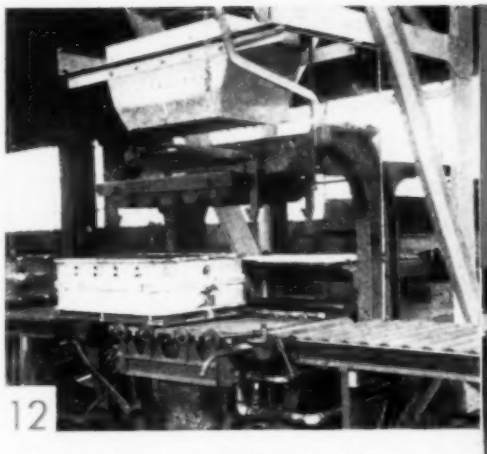
THE 1002 . . a distinctly new moulding unit . . a Cope and Drag Jolt Roll-over Squeeze Pattern Draw and Closing Machine . . . makes complete moulds from 28"x42" match plate patterns.

6 Bottom board clamped in place . . . mould rolling over.

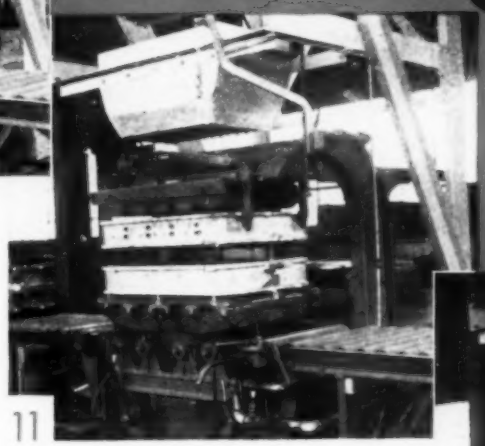


OSBORN

in Action

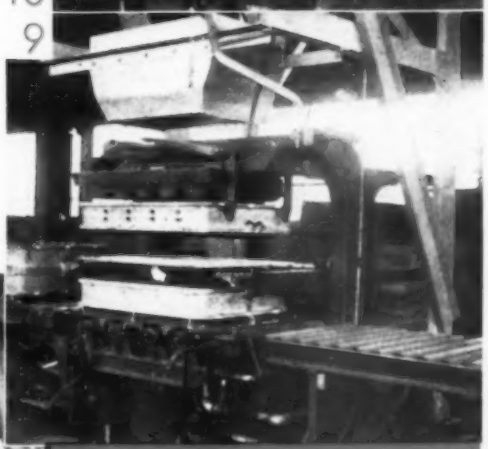


12 Mould leaving the machine, ready to pour.

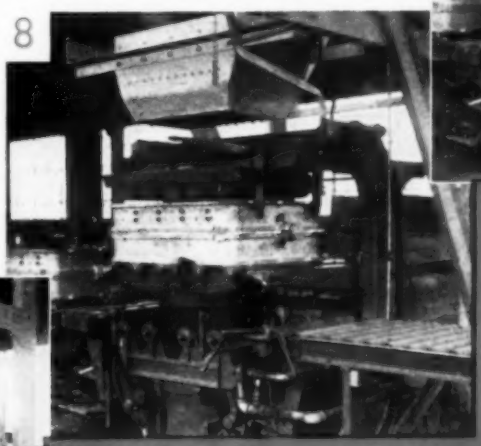


11 Mould being closed.

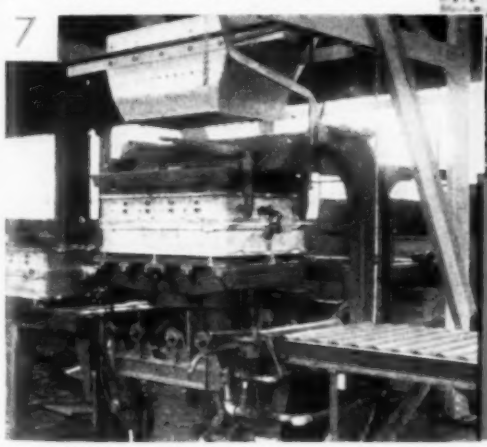
10 Match plate removed.



9 Both cope and drag pattern draws are completed.



8 As mould descends cope is held.



7 Cope filled and jolted. Both cope and drag are being squeezed at the same time.

THE illustrations show that these larger moulds are made as ordinary squeezer moulds are made . . and the time required is approximately the same. The 1002 machine is fast!

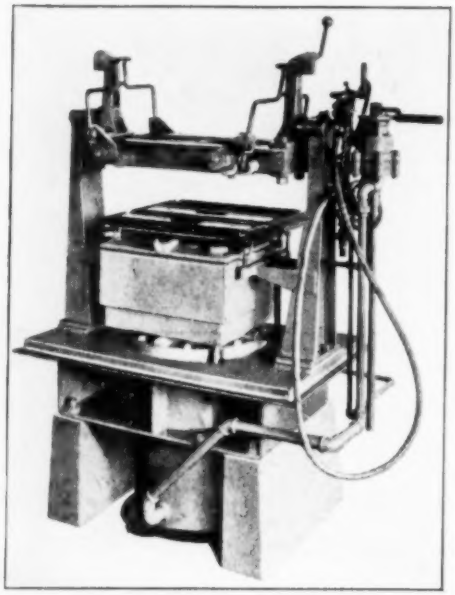
THE OSBORN MANUFACTURING COMPANY
INCORPORATED

5401 Hamilton Ave. · Cleveland, Ohio, U. S. A.

OSBORN

Some TABOR MACHINES

that we would have shown at Philadelphia

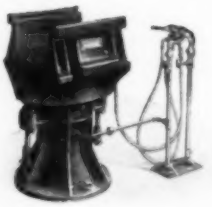


Shockless Jar Squeeze
Hand Trunnion Rollover
Power Pattern Draw Machine

The Technical Sessions of the A.F.A. Convention at Detroit May 3-5 plan for a series of papers that will be most helpful and instructive to all foundrymen. . . . Attend if at all possible, as the benefits derived by you will far exceed the small expense involved.

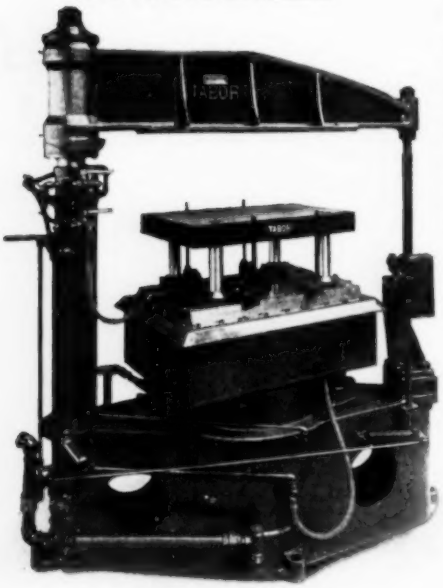
●

Then give us an opportunity to show you how TABOR machines will help you to profit further from the advantages gained by producing more and better molds at lower cost.

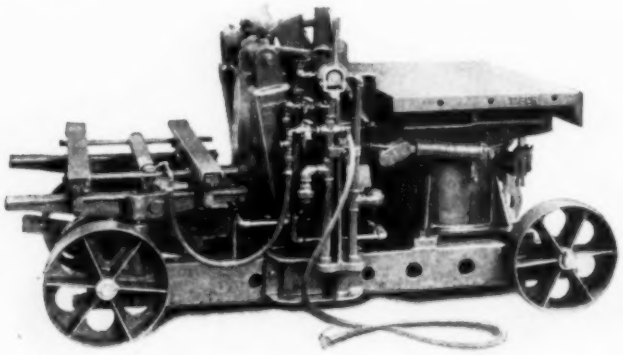


Jarring Flask Lift Machine
(Plain or Shockless Jar)

Power Squeezing
Split Pattern Machine



Shockless Jarring-Squeezing
Flask Lift Machine



Jarring, Rollover and Pattern Drawing Machine
(Plain or Shockless Jar)

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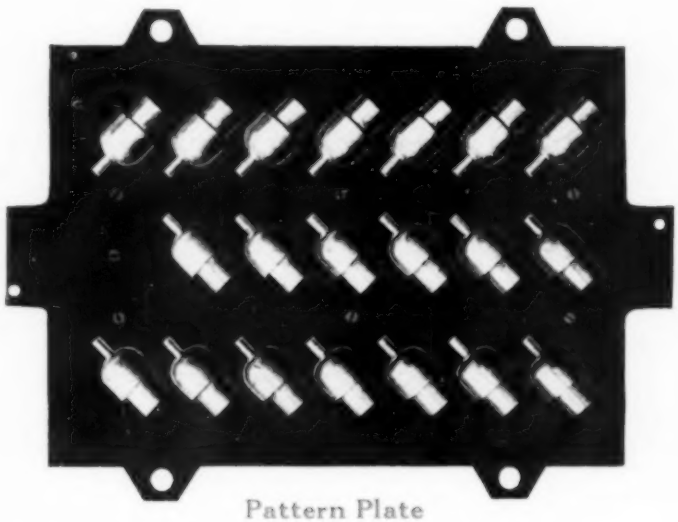
Made from specially prepared steel reinforced with two light gauge 1″ x 2″ channels, electrically welded. *Perforations let gases escape* and castings cool faster.



Pattern Plate

Core Plate

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The problem is how can you manage to get the most work done from the fewest machines . . . with the minimum of skilled labor . . . at the lowest cost.

The Johnston & Jennings Company, makers of a complete line of molding machines, squeezers, strippers, and the like, will gladly send an Engineer to consult with you on your problems.

There's no obligation attached to this offer. Avail yourself of it TODAY. Simply write us.

Air
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Operated
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Throughout
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Jolt
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Clamp
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Leveler
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Roll-over
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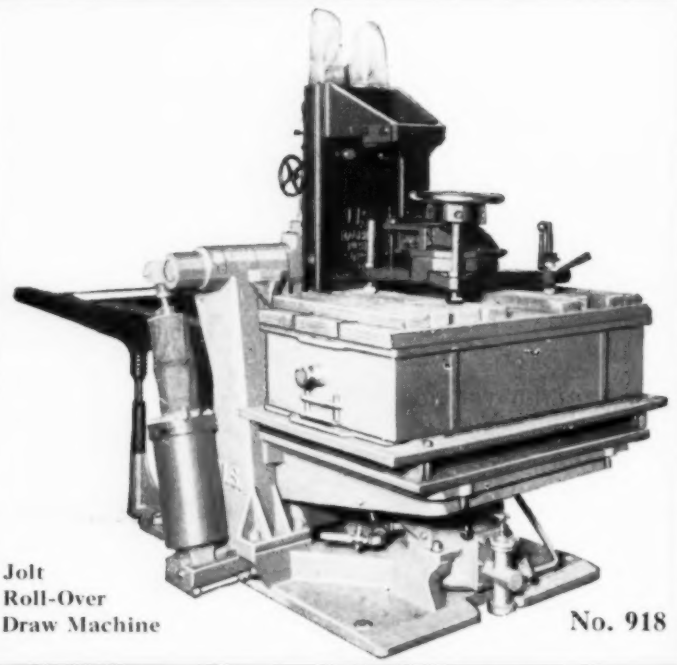
Draw



Jolt
Roll-Over
Draw Machine
No. 918

Requires no pit
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All working parts
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fully enclosed
«
Built in several sizes
«
quickly
«
adjustable for
«
various sizes
«
of flasks

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The JOHNSTON & JENNINGS *Company*

Addison Road and N. Y. C. Tracks — Cleveland, O.

ROYER SCRAP REMOVER

in combination with the

ROYER SAND SEPARATOR AND BLENDER

CAPACITY - - *30 to 50 tons of sand per hour*

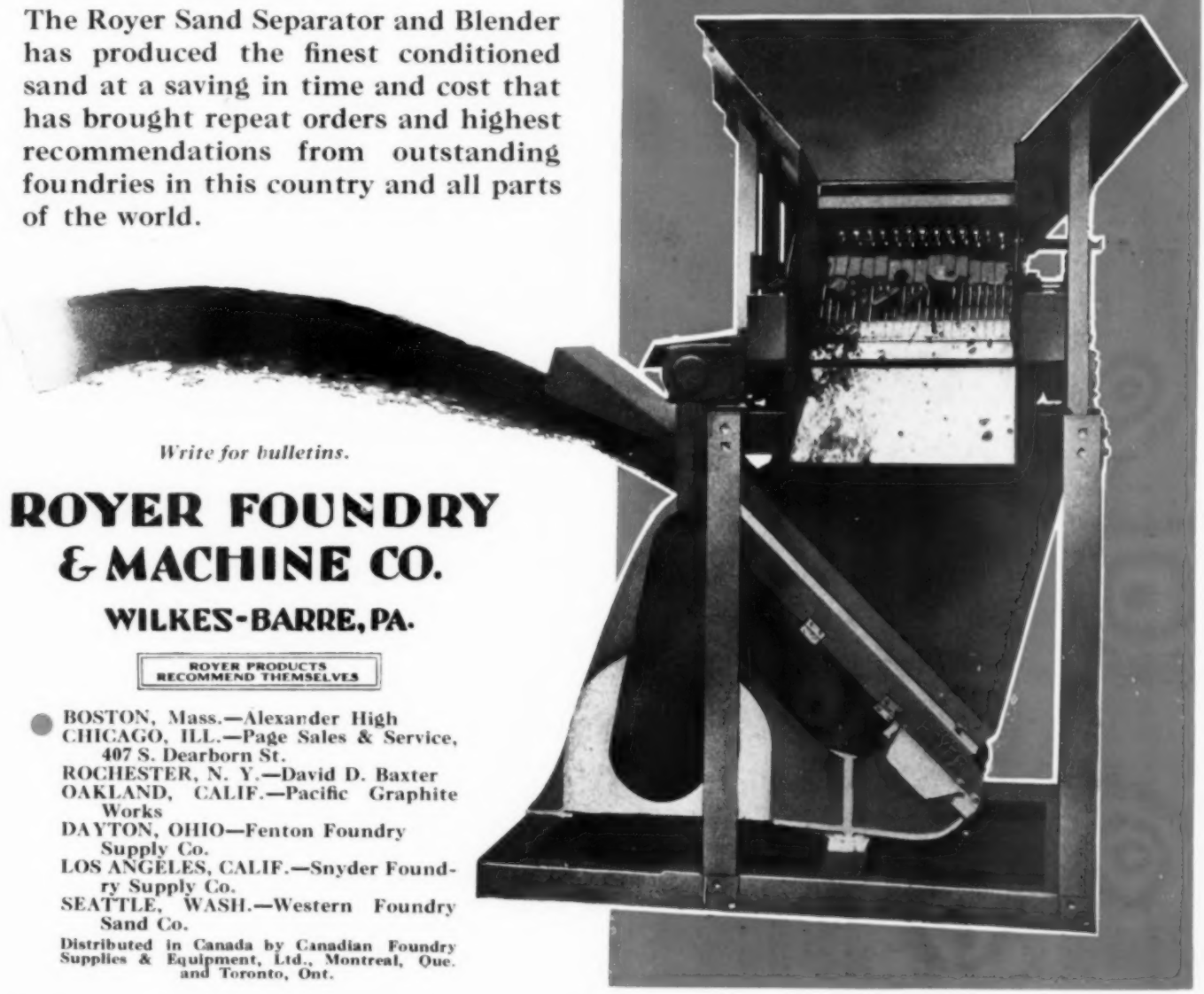
In One Operation

REMOVES SCRAP AND PREPARES SAND FOR IMMEDIATE RE-USE.

The Royer Scrap Remover is not only entirely mechanical in operation but operates on a principle which is a distinct departure from all previous methods of removing gaggers, gates, nails, etc., from sands in ferrous and nonferrous foundries.

The Royer Sand Separator and Blender has produced the finest conditioned sand at a saving in time and cost that has brought repeat orders and highest recommendations from outstanding foundries in this country and all parts of the world.

Two Great Labor-Savers in One



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"In our opinion any sizeable melters of iron who do not take advantage of this latest refinement in cupola practice are overlooking one of the greatest possibilities for large savings and infinitely better melting conditions."
—Maryland Car Wheel Company, Baltimore

THIS foundry, melting 160 tons of iron daily, has for several years utilized the Griffin Hot-Blast System after plenty of previous experience with the same cupola equipment operating on cold blast. The enthusiasm of the owners concerning the decided improvements effected by the Griffin Hot-Blast Process is therefore a safe guide to any other iron foundry seeking worth-while means for cutting production costs and making better castings.

The improved combustion and high temperatures within the cupola, together with the waste heat recovery and utilization, as effected by the Griffin Hot-Blast Process, offer you some highly desirable combination of the following benefits:

Extremely sensitive cupola control, with smooth combustion and melting and the resulting improvement in physical and chemical properties of the melted metal.

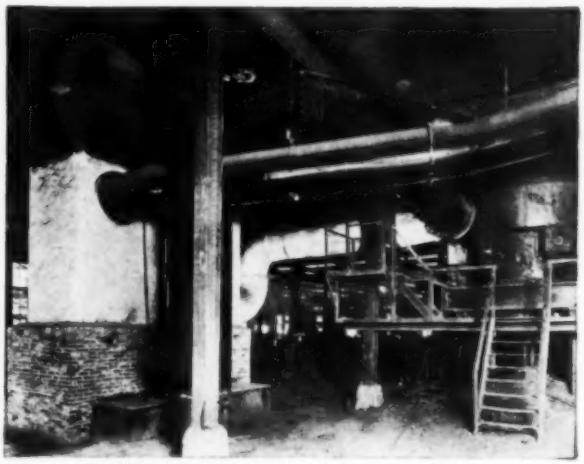
Superheat in the molten metal. The resulting fluidity and free pouring quality makes all castings better, and in the pouring of thin-walled castings greatly reduces the number of rejections. Where thinness has previously been limited by the foundry practice, thinner walls can be used with corresponding saving in metal.

Over 10 per cent cupola capacity increase due to faster melting rate.

Over 25 per cent coke saving, due to more complete heat extraction and utilization.

Saving in labor and power in that less coke and limestone are charged into the cupola, with fewer trips of the charging buggies.

The capacity increase and better fuel economy as effected by the Griffin Hot-Blast Process make a highly profitable definite dollars-and-cents showing on the annual balance sheet. The improvement in cupola operations and the better quality of the finished castings are not so easily figured, but their value has proven greater than that of the capacity increase and the fuel saving.



Griffin Hot-Blast installation at foundry of Maryland Car Wheel Company

Finding what benefits the Griffin Hot-Blast Process can produce in your own plant would cost you nothing as no obligation is involved in having us make preliminary report, and submit performance figures and guarantees.

Write at least for Bulletin 531

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The GRIFFIN Hot-Blast Process

"Fifth Ave. Castings" *are made with* SEMET-SOLVAY COKE

THE Stockham Pipe and Fittings Co., of Birmingham, Ala., have for years relied upon Semet-Solvay Coke to "bring their iron down hot". When they contracted to furnish the fittings for the complete plumbing, fire line, ventilating and vacuum systems, to be installed in the world's tallest building, they used Semet-Solvay Coke for the job.

• • •

Foundrymen tell us - -

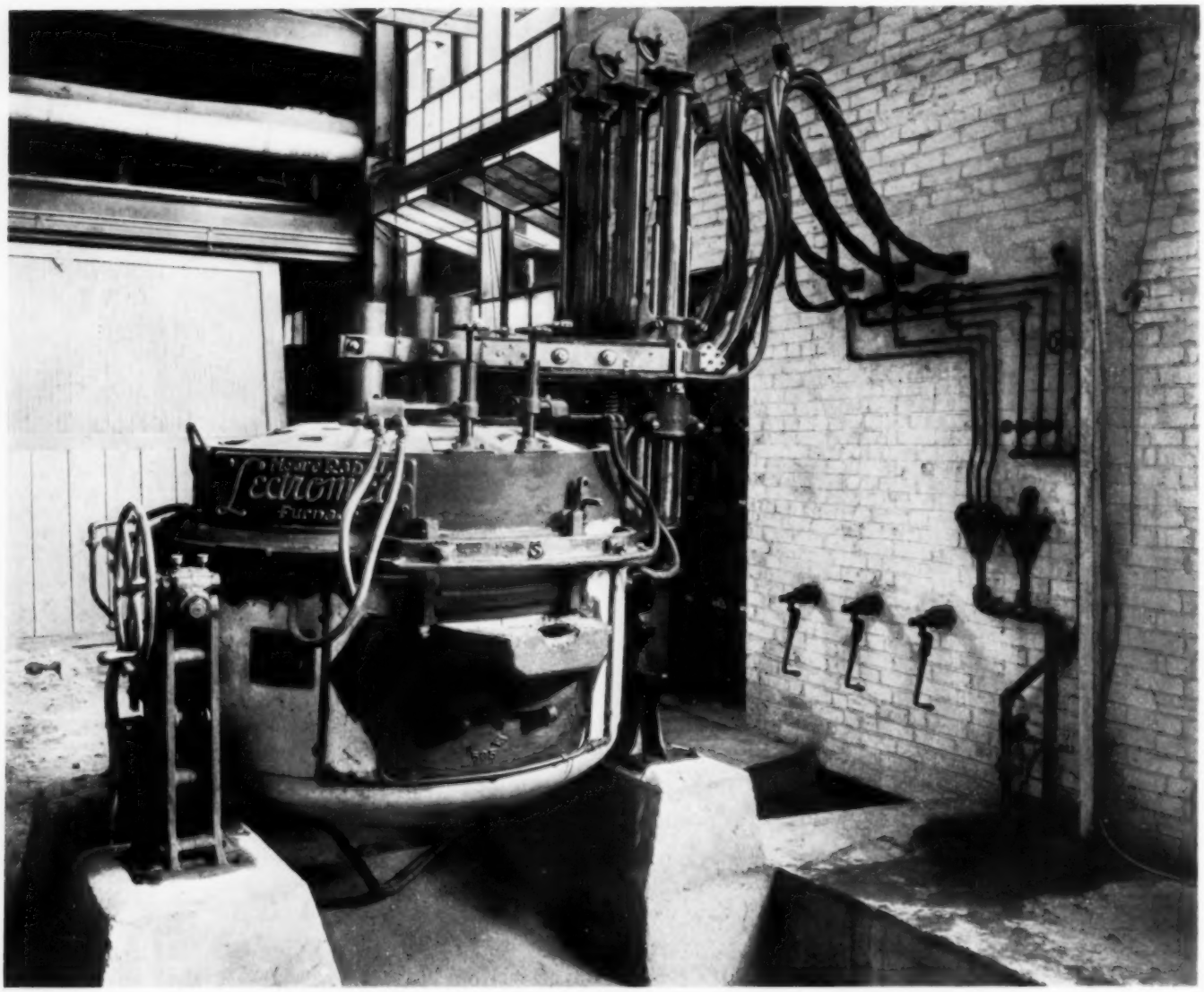
that never has there been coke of finer quality than Semet-Solvay is shipping them right now. You can depend upon its firmness and uniform analysis for any job that comes along. Try it now.

• • •

SEMET-SOLVAY COMPANY

61 Broadway, New York

For Your Specification Gray Iron Production . . .



A 1000 Pound Per Hour LECTROMELT Gray Iron Furnace

Lectromelt and LECTROSIMPLEX FURNACES

LECTROMELT 3 phase direct arc furnaces in sizes to 50 tons capacity. LECTROSIMPLEX single phase direct arc furnaces in sizes to 3000 pounds capacity.

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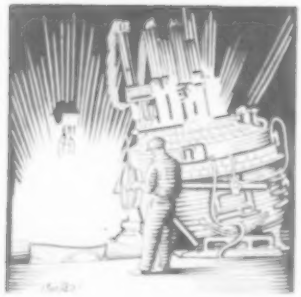
LARGEST BUILDERS OF ELECTRIC FURNACES EXCLUSIVELY IN THE WORLD



THE FOUNDRY for April

The Foundry

MONTHLY

WE make our bow. The first words spoken editorially almost forty years ago again mark a new phase in the publishing concept of this paper. Vision, initiative, faith and force are elements essential in the reconstruction period. The foundry industry possesses these characteristics and will prevail.

The change to a monthly basis, announced in earlier issues, was made by the publishers of THE FOUNDRY in the interests of better service. Careful selection, weighing each item against the present need and brevity to conserve the readers' time and effort shall govern.

To repeat a further statement of principle in THE FOUNDRY, first issue, "THE FOUNDRY will stand squarely for what, in its opinion, are the best interests of the whole business. No section thereof will be overlooked, and the importance of none unduly magnified."

Always Ready

TO SERVE

POWER and demand charges bear down. Foundries, leaders in advanced practice, have installed electric furnaces to make steel, special gray iron and brass. Some of these are penalized. Many today suffer severely under special demand charges. Electric furnace manufacturers and interests allied with these foundries penalized for their advanced enterprise, have been successful in lowering a few.

Are demand charges the archaic survival of the old days of small, independently owned electric plants? When established, the reason given for demand charges was the necessity for financing, building and maintaining excess capacity for peak load requirements. With integration into large systems, the feeding in and drawing off of current from far flung power lines, how much of this demand charge is an inherited habit? How much just pyramided profits?

Ready to serve charges might help foundries pay the overhead on idle equipment. Too bad foresight did not supply this item added to castings prices years ago. The off peak demand charges on idle molding machines, furnaces, conveyors, sandblasts, if paid by foundry customers might even provide attractive basis for taxes!

What's New

IN APRIL

THE American Foundrymen's association, great technical organization of the industry, gathers leaders for group and general discussion on problems of manufacture and technique, May 2 to 5. Co-operation of a division of American Society of Mechanical Engineers furthers alliance of producer and consumer of castings to mutual advantage. Detroit foundry and pattern interests contribute city's unflagging optimism. (page 22 and following)

Actual details, intimate and complete, describe machines invented to cast gray iron in a steel shell for automotive brake drums. This the most far reaching advance in foundry adaptation in recent years is explained first in THE FOUNDRY. (page 40)

Advancement and change await only the quickening pulse of business. Looking over the horizon, facts and foresight in foundry developments are given, at Short Range. (page 57)

Specifications

CATCH UP

CAST iron moved out years ago and left no address. Inquiries in handbooks, stampings pamphlets, and most specifications give the old location. Gray iron higher up the street in physical properties, a family of useful cast metals, has remained unrecognized in outdated directories.

The American Society for Testing Materials has undertaken to set inquirers aright. Data is contributed by the Gray Iron Institute co-operating through two years study and tests. Earnest work by keen metallurgists and engineers in company with users will supply the designated ranges wherein gray iron may be found today. Thus gray iron will better serve the needs of castings buyers.

Commendation is offered by the foundry industry for this worthy undertaking.

All activities of the 1932 convention will center at the Hotel Statler

Detroit Convention Challenges Foundry Industry

DETROIT, the selection of the American Foundrymen's association for its thirty-sixth annual convention, eagerly awaits the gathering of foundrymen and engineers for the sessions, May 2 to 5. The designation of motordom's capital for the 1932 technical sessions has met with favorable response from the industry. The city stands at the forefront of American industrial accomplishment. Its tremendous automotive plants and those devoted to a wide range of miscellaneous products are symbols of accomplishment and a challenge to the initiative and optimistic confidence of every manufacturer. The foundry industry should absorb inspiration, needed and valuable, from the spirit of Detroit.

ACTION to defer the exhibition to the spring of 1933, retaining Philadelphia, center of the eastern district, as the next year's locale has been acclaimed. Equipment manufacturers, many of whom have important improvements and innovations under development and not yet ready for demonstration are particularly appreciative.

A varied program of unusual interest has been prepared for the Detroit sessions which will be held at the Hotel Statler. This has been planned with a view to present conditions in the industry and in expectation of serving foundrymen in the reconstruction period. The newer cast metals, features of casting design, shop methods and economies are stressed in the papers and discussions, described later in this issue.

Co-operation of the American Society of Mechanical Engineers in the presentation of addresses and group study under sponsorship of the management, maintenance and materials handling division offers mutually attractive features to the engineers and to foundrymen. No better examples of the economy and utility of mechanical handling can be found than those displayed in the foundries of the convention city. In fact, Detroit led in appreciation that handling is an important item in costs and foundries of the city were among the first to adapt conveyors.

Washington boulevard looking north toward the Hotel Statler and Grand Circus Park

carriers and cranes to castings manufacture.

Three major trade associations of the foundry industry will hold meetings during foundrymen's week in Detroit. The Gray Iron institute and the Malleable Iron Research institute, representing two important branches of the castings industry plan sessions and luncheons. The Foundry Equipment Manufacturers' association plans a luncheon and an afternoon conference Wednesday. Further, the Electric Hoist Manufacturers association and Materials Handling institute will hold sessions. Headquarters of these associations will be maintained at Hotel Statler, where all of the technical sessions and business meetings of the various organizations will be held. An informal dinner for men will be held Wednesday evening with Major Norman A. Imrie, Culver Military academy, Culver, Ind., as speaker.

FULL opportunity will be given visiting foundrymen, metallurgists and engineers to inspect local plants. Local arrangements are in the hands of a competent committee, many of whom have previously been active as hosts to the American Foundrymen's association. The cordiality of the Detroit foundrymen in 1926, when the International Foundry congress brought thousands of visitors from America and many foreign lands, long will be remembered.

Several committees have been appointed by the Detroit Foundrymen's association to welcome visitors to the annual convention. James L. Mahon, American Car & Foundry Co., president of the Detroit association, is acting as general chairman of the committees and Neil I. MaArthur, Great Lakes Foundry Sand Co., secretary of the Detroit group, is general secretary. Chairmen of the committees are as follows: Reception, William J. Muhlitner, Great Lakes Foundry Sand Co.; plant visitation, Russell M. Scott, Packard Motor Car Co.; golf, Vaughan Reid, City Pattern Works, and ladies reception, Mrs. George L. Grimes. Members of the various committees are presented on page 27.

The Fisher building, one of the new and modern office buildings of Detroit

Plans of the plant visitation committee include an organized tour on Monday afternoon, covering the Hanna Furnace Corp. and the Great Lakes Steel Corp., a division of the National Steel Corp. The group will leave the hotel at 2 p.m. on Monday, May 2, and will go first to the Great Lakes plant, where the visitors will witness the receiving of metal from the furnace in special, mixer-type, ladle cars, the transfer of the metal to the open hearths, tapping the open hearths, casting the ingots, the soaking pit, and the finishing mills where the steel ingot is

Detroit's impressive skyline as seen from the Canadian side of the Detroit River—Photo by Grossman-Knowling, Inc.

converted into billets, slabs, wide strip and merchant bars. The Great Lakes plant is the latest complete steel mill built in this country and therefore should be of unusual interest. From the mill, the party will be conducted to the Hanna Furnace Corp. plant where the metal will be cast from the blast furnace into the mixer type ladles for transportation to the mill several miles away.

On remaining days of the convention, members of the visitation committee will be at the association headquarters to give information on the plants which will receive visitors during convention week. Information on golf facilities will be made available by that committee, and general information on Detroit and its points of interest may be secured from the ladies reception committee.

ALL gray iron foundrymen are invited to attend the luncheon meeting of the Gray Iron institute at the Hotel Statler on Tuesday May 3, with Arthur E. Hageboeck, Frank Foundries Corp., Moline, Ill., and president of the institute, presiding. Oliver J. Smalley, technical director of the institute will outline the progress which has been made by the technical department of that organization and will show the value of that work to the members of the institute. He also will report on the recent developments in the gray iron test bar situation and will explain the co-operative work which is being undertaken by the American Society for Testing Materials and the Gray Iron institute to set up new specifications for test bars. Albert E. Grover, recently appointed cost director of the institute will present the cost work of the organization and will outline suggestions covering certain improvements in cost practices. Arthur J. Tuscany, manager, will report on the progress which has been made since the annual meeting six months ago and will outline plans covering activities for the remainder of the year. He also will report on the progress which is being made in the group plan of organization. An open forum and discussion will follow.

Malleable Iron Research institute has scheduled the following committee meetings for Wednesday morning, May 4, at the Hotel Statler: Research committee, R. J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich., chairman; railway sales promotion committee, F. R. Angell, Northern Malleable Iron Co., St. Paul, Minn., chairman; automotive sales promotion committee, L. P. Henry, Maumee Malleable Castings Co., Toledo, O., chairman; and miscellaneous sales promotion committee, L. J. Wise, Chicago Malleable Castings Co., chairman.

REPORTS of those committees will feature the regular meeting of the institute which will begin with a luncheon at the Hotel Statler May 4. Other reports of a committee character will comprise a review of the proposed report of the National Safety council on "Health Protection in Air Pressure Cleaning." President Griest of the institute also will report on the proceedings of the American Railway association specifications committee on properties of air furnace fittings and cupola fittings. An invitation has been extended to all nonmember producers of malleable castings to attend.

Foundry Equipment Manufacturers association will hold a luncheon meeting at the Hotel Statler on Wednesday noon, May 4, with Herbert S. Simpson, National Engineering Co., Chicago, and president of the association, in the chair. A special program is being arranged for the meeting The buffet dinner and smoker of the Materials Handling institute will be held Thursday evening, May 5, at the Hotel Statler.

Preliminary to the opening session of the

Session Schedule For Convention Week

Monday, May 2

9:00 a.m.—Registration
Plant Visitations
10:00 a.m.—Committee on Foundry Education in Engineering Schools.
Committee on Nomenclature
Committee on Molding Sand Research
Gray Iron Division
2:00 p.m.—Plant Visitation
Sand Control Course
4:00 p.m.—Gray Iron Shop Course

Tuesday, May 3

9:00 a.m.—Sand Control Shop Course
9:45 a.m.—Opening Meeting
10:30 a. m.—Steel Founding
Nonferrous Founding
1:00 p.m. — Nonferrous Roundtable Discussion
Steel Roundtable Discussion
Gray Iron Roundtable Discussion
2:00 p.m.—Committee on Foundry Refractories
4:00 p.m.—Steel Shop Course
Gray Iron Shop Course
Nonferrous Shop Course
8:00 p.m.—Sand Research

Wednesday, May 4

9:00 a.m.—Sand Shop Course
10:00 a.m.—Steel Division
Nonferrous Founding
Gray Iron Founding
12:30 p.m.—Pattern Production Roundtable Discussion
2:00 p.m.—Apprentice Training
4:00 p.m.—Steel Shop Course
Gray Iron Shop Course
Nonferrous Shop Course
7:00 p.m.—Dinner of American Foundrymen's association and Foundry Equipment Manufacturers' association

Thursday, May 5

9:00 a.m.—Sand Control Shop Course
9:30 a.m. — Annual Business Meeting
10:30 a.m.—Gray Iron Founding
Malleable Founding
1:00 p.m.—Malleable Roundtable discussion
2:00 p.m.—Materials Handling
4:00 p.m.—Malleable Division
Gray Iron Shop Course
Nonferrous Shop Course

Friday, May 6

Plant visitations

Tentative Program of Technical Papers To Be Presented at the Sessions

Monday, May 2

9:00 a. m.—Registration

10:00 a. m.—Committee Meetings

2:00 p. m.—Sand Control Shop Course

4:00 p. m.—Gray Iron Shop Course

Tuesday, May 3

9:00 a. m.—Sand Control Shop Course

9:45 a. m.—Opening Meeting

10:30 a. m.—Steel Founding

Reports of Committees.

Production and Application of Manganese Steels in Australia, by D. Clark and J. Coutts, Newcastle, N.S.W., Australia. (Exchange paper of Bureau of Steel Manufacturers of Australia).

Manufacture of Stainless Steel Castings, by T. Holland Nelson, Philadelphia.

Some Factors Affecting the Cleanliness of Steel Castings, by Dr. C. H. Herty Jr., C. F. Christopher and M. W. Lightner, Carnegie Institute of Technology, Pittsburgh.

10:30 a. m.—Nonferrous Founding

Refractories in Brass Melting Practice, by A. E. Rhoads, Detroit Electric Furnace Co., Detroit.

Phosphorus in Red Brass, by R. W. Parsons, Ohio Brass Co., Mansfield, O.

A Method for Study of Shrinkage and Its Distribution in Castings, by N. B. Pilling and T. E. Kihlgren, International Nickel Co., New York.

1:00 p. m.—Nonferrous Roundtable

1:00 p. m.—Steel Roundtable Discussion

1:00 p. m.—Gray Iron Roundtable

4:00 p. m.—Shop Courses

Steel, Gray Iron and Nonferrous Founding.

8:00 p. m.—Sand Research

Reports of Committees.

Grain Size and Bond Distribution in Synthetic Molding Sand, by A. H. Dierker, engineering experiment station, Ohio State university, Columbus, O.

Mold Condition Control, by H. W. Dietert, U. S. Radiator Corp., Detroit.

German Sand Control Methods, by Dr. H. Ries, Cornell university, Ithaca, N. Y.

Wednesday, May 4

9:00 a. m.—Sand Shop Course

10:00 a. m.—Nonferrous Founding

Casting Properties of Nickel Bronzes, by N. B. Pilling and T. E. Kihlgren, International Nickel Co., New York.

Influence of Design on Brass and Bronze Castings, by L. H. Fawcett, naval gun factory, Washington.

Nonferrous Division Business Meeting.

10:00 a. m.—Gray Iron Founding

Use of Silicon and Manganese Briquets in the Cupola, by L. H. Ransom, Keystone Driller Co., Beaver Falls, Pa.

High Test Irons, by H. H. Judson, Goulds Pumps Inc., Seneca Falls, N. Y.

Pearlitic Cast Irons, by H. J. Young. (Exchange paper of the Institute of British Foundrymen).

Use of Molybdenum in Cast Iron, by J. Kent Smith and E. R. Young, Climax Molybdenum Co., Detroit.

12:30 p. m.—Pattern Production Roundtable

2:00 p. m.—Apprentice Training

How Much Does It Cost to Train Foundry Apprentices? by J. Franklin Carlz, Clark Bros. Co., Olean, N. Y.

Successful Foundry Apprenticeship in a Small Manufacturing Plant, by W. E. Rutz, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

4:00 p. m.—Shop Courses

Steel, Gray Iron and Nonferrous Founding.

7:00 p. m.—Dinner of A. F. A. & F. E. M. A.

Thursday, May 5

9:00 a. m.—Sand Control Shop Course

9:30 a. m.—Annual Business Meeting

10:30 a. m.—Gray Iron Founding

Melting High Test Iron in the Brackelsberg Furnace, by D. J. Reese, Whiting Corp., Harvey, Ill.

A Shop Method for Determining Volume Changes Occurring in Cast Iron During Melting, by C. M. Saeger Jr. and E. J. Ash, bureau of standards, Washington.

The Open Hearth Furnace as a Means of Recovering Cast Iron Borings, by T. L. Joseph and C. E. Wood, bureau of mines, North Central experiment station, Minneapolis.

10:30 a. m.—Malleable Founding

High Silicon Pig Iron for Malleable Iron Manufacture, by A. L. Boegehold, General Motors Research Laboratory, Detroit, and C. F. Joseph, Saginaw Malleable Iron Co., Saginaw, Mich.

Short Cycle Malleablizing, by H. W. Highriter, Malleable Iron Research institute, Cleveland, and R. Schneidewind, University of Michigan, Ann Arbor, Mich.

Effect of Thermal Treatment on Characteristics of Blackheart Malleable Iron, by Dr. Tario Kikuta, Tobato Foundry Co., Tokyo, Japan.

1:00 p. m.—Malleable Roundtable

2:00 p. m.—Materials Handling (A. S. M. E. Co-operating)

Monorail Materials Handling and the Foundry, by J. B. Forker, Osborn Mfg. Co., Cleveland.

Materials Handling for Miscellaneous Castings, by F. D. Campbell, Eastern Corp., New York.

Materials Handling in the Small Brass Foundry, by D. G. Anderson and B. F. McAuley, Western Electric Co., Chicago.

4:00 p. m.—Shop Courses

Gray Iron and Nonferrous Founding.

Plan Shop Courses And Committee Meetings

Monday, May 2

10:00 a.m.—Committee on Molding Sand Research
Joint Committee on Foundry Education in Engineering Schools
Gray Iron Division
Committee on Nomenclature
2:00 p.m.—Sand Control Shop Course
4:00 p.m.—Gray Iron Shop Course

Tuesday, May 3

9:00 a.m.—Sand Control Shop Course
2:00 p.m.—Joint Committee on Foundry Refractories
4:00 p.m.—Steel, Gray Iron and Nonferrous Founding Shop Courses

Wednesday, May 4

9:00 a.m.—Sand Control Shop Course
10:00 a.m.—Steel Division
4:00 p.m.—Steel, Gray Iron and Nonferrous Founding Shop Courses

Thursday, May 5

9:00 p.m.—Sand Control Shop Course
4:00 p.m.—Malleable Division
Gray Iron, and Nonferrous Founding Shop Courses

technical program several committee meetings will be held Monday morning at 10 o'clock. Committees meeting at that time include the joint committee on foundry education in engineering schools, gray iron division, committee on nomenclature and the committee on molding sand research. On Tuesday afternoon the joint committee on foundry refractories will meet and the committee on apprentice training also will meet on Tuesday at a time to be announced later. The steel division will hold a meeting Wednesday and the malleable division on Thursday.

SHOP operation courses and roundtable discussions as usual will form an important feature of the convention week. In all 12 shop courses and 5 roundtable discussions have been arranged. Roundtables on nonferrous cast metals, steel castings, gray iron founding, pattern production and malleable cast iron will be held.

The first shop operation course will be on sand control and is scheduled for 2 o'clock on Monday followed by one on gray iron founding at 4 o'clock. A sand control shop operation course

Tentative Technical Program Management and Materials Handling

Wednesday, May 4

9:00 a. m.—Registration

9:40 a. m.—Opening Morning Session

Maintenance of Materials Handling Equipment, by T. A. Bissell, *Maintenance Engineering.*

Relative Wear of Metals by Abrasion, by C. R. Weiss, Link-Belt Co., Indianapolis.

Management Policies and Practices in a Continuous Production Gray Iron Foundry, by W. G. Reichert, Singer Mfg. Co., Elizabethport, N. J.

1:30 p.m.—Inspection Trip to Ford Motor Co.

6:30 p. m.—A. S. M. E. Dinner at Detroit Yacht Club

Thursday, May 5

9:30 a. m.—Joint Management and Materials Handling Session

Plant Layout by Products Instead of by Parts, by Louis Berg, A. C. Spark Plug Co., Flint, Mich.

9:30 a. m.—Waste Elimination Symposium

Elimination of Waste in Foundry, by E. S. Carman, Edwin S. Carman Inc., Cleveland.

Weekly Accounting of Waste, by S. K. Cooper, Johns-Manville Co., Manville, N. J.

Maintaining Interest in Suggestion Systems, by Prof. W. E. Fisher, University of Pennsylvania, Philadelphia.

Savings by Substitution of Other Materials, by George Bangs, Nassau Smelting & Refining Co., New York.

Common Savings in Shop Wastes, by C. B. Hall, Pennsylvania Railroad Co., Philadelphia.

10:30 a. m.—Moving Pictures of Materials Handling

12:15 p. m.—Luncheon Meeting

Discussion on Export Trade and Economic Control.

2:30 p. m.—Management Session

Knowledge of Markets and Its Effect on Product Design, by Prof. R. F. Elder, Massachusetts Institute of Technology, Cambridge, Mass.

Man-hour Analysis of Productivity of Industry as Revealed by Unusual Data Gathered by Census Bureau, by L. P. Alford, Ronald Press, New York, and J. E. Hannum, *Engineering Index*, New York.

2:30 p. m.—Joint Session with A. F. A.

Monorail Materials Handling and the Foundry, by J. B. Forker, Osborn Mfg. Co., Cleveland.

Materials Handling for Miscellaneous Castings, by F. D. Campbell, Eastern Corp., New York.

Materials Handling in the Small Brass Foundry, by D. G. Anderson and B. F. McAuley, Western Electric Co., Chicago.

6:30 p. m.—Buffet Dinner and Smoker

Vaughan Reid | Mrs. G. L. Grimes | W. J. Muhl'tner | Russell Scott

Detroit Committees for A.F.A. Convention

James L. Mahon, Gen. Chairman
American Car & Foundry Co.
Neil I. McArthur, Secretary
Great Lakes Foundry Sand Co.

Reception Committee

William J. Muhlitner, Chairman
Great Lakes Foundry Sand Co.
S. Wells Utley
Detroit Steel Castings Co.
Fred Erb
Eaton-Erb Foundry Co.
W. H. J. Cluff
Frederick B. Stevens Inc.
Jesse D. Stoddard
Detroit Testing Laboratory
Hutton H. Haley
American Foundry Equip. Co.
Kurt C. Babo
Dodge Brothers
J. C. Woodison
E. J. Woodison Co.
W. Edward Thompson
Warner R. Thompson Co.
Peter W. Mulder
Almont Mfg. Co.
Frank H. Dodge
Werner G. Smith Co.
James W. Dopp
Fred A. Cowen
Hickman, Williams & Co.
George L. Grimes
Grimes Molding Machine Co.

Plant Visitation Committee

Russell M. Scott, Chairman
Packard Motor Car Co.
John W. Collins
U. S. Aluminum Co.
Hugh Martin
Detroit Gray Iron Foundry Co.
Harry Rayner
Dodge Brothers
Fred J. Walls
Wilson Foundry & Machine Co.
John A. Moore
Acme Foundry Co.
Harry W. Dietert
U. S. Radiator Corp.
Matt P. Drennan
Sand Products Corp.
Leslie G. Korte
Riley Stoker Corp.
Elton T. Rogers
Sandwich Foundry Ltd.
E. Kay Ford
Hanna Furnace Corp.
Harry L. St. John
Detroit Lubricator Co.
Glenn Coley
Detroit Edison Co.
F. Burnham Finney
Iron Age

Golf Committee

Vaughan Reid, Chairman
City Pattern Works
Clarence H. Miller
Standard Pattern Works
William B. Crawford
Atlas Foundry Co.
John D. Cronenweth
Great Lakes Foundry Sand Co.

Ladies Reception Committee

Mrs. George L. Grimes, Chairman
Mrs. Vaughan Reid, Vice Chairman
Mrs. Hugh Martin, Vice Chairman
Mrs. S. Wells Utley
Mrs. Fred Erb
Mrs. W. H. J. Cluff
Mrs. P. W. Mulder
Mrs. Robert Crawford
Mrs. Kurt C. Babo
Mrs. John C. Woodison
Mrs. Warner R. Thompson
Mrs. Frank Dodge
Mrs. John A. Moore
Mrs. Albert Weber
Mrs. Russell M. Scott

will be held Tuesday morning with shop operation courses on steel founding, gray iron founding and nonferrous founding at 4 o'clock. The third course on sand control opens Wednesday morning followed by shop courses in steel founding, gray iron founding and nonferrous founding at 4 o'clock. The last sand control course with the final courses in gray iron and nonferrous founding will be held Thursday.

Papers to be presented at the various technical sessions have been selected with extreme care by the papers and program committee. Steel foundrymen will find much of interest in these to be presented at the steel session to be held Tuesday morning. Papers have been prepared on the production and application of manganese steels in Australia, stainless steel castings manufacture and the cleanliness of steel castings.

Two sessions will be held on nonferrous founding on Tuesday and Wednesday mornings. Topics to be covered in the various papers deal with refractories, phosphorous, shrinkage, nickel bronzes, and influence of casting design. On Tuesday evening a sand session will be held.

Gray iron founding will have two sessions on Wednesday and Thursday. They will include use of alloy briquets, high test irons, use of molybdenum, Brackelsberg furnace, volume changes in cast iron during melting, and the recovery of cast iron borings. One session will be held on malleable iron founding on Thursday.

A joint session of the American Foundrymen's association and the American Society of Mechancal Engineers on materials handling will be held Thursday afternoon. Papers on the application of monorail castings handling, methods for handling miscellaneous castings, and handling methods for small brass foundry will be presented at the session. Papers to be presented at the session on apprentice training on Wednesday afternoon will deal with the cost of training apprentices, and training apprentices. A joint meeting of the A.F.A. and the Gray Iron institute will be held on Tuesday afternoon at 2 o'clock to discuss foundry costs. A. E. Grover, cost director, Gray Iron institute will lead the discussion.

James L. Mahon, American Car & Foundry Co., president Detroit Foundrymen's association

Neil I. McArthur, Great Lakes Foundry Sand Co., secretary Detroit group

Industry Benefits Through Detroit Association Activities

SINCE the founding of the Detroit Foundrymen's association in 1907 by a group of leading foundrymen of the Michigan metropolis and surrounding territory, its activities and the contributions of its members have had a wide influence on the manufacture of castings. The pioneering work of Detroit foundrymen, many of them members of the local organization, has been instrumental in the development of processes and products which have spelled remarkable progress in the foundry industry. At the same time, the association and its members have been active in the work of national organizations related to the various phases of castings manufacture.

Rapid growth of the foundry industry, particularly that part of it connected directly or indirectly with the manufacture of automobiles brought many outside foundrymen to Detroit, presented new problems in foundry operation and created a sentiment which finally crystallized in the formation of the Detroit Foundrymen's association with an initial membership of 50. An item in the July, 1908, issue of THE FOUNDRY indicates a membership of 100.

The first list of officers, according to THE FOUNDRY, included: President, W. M. Corse; vice president, J. J. Wilson; secretary, A. P. Henry; treasurer, A. H. Waterfall. In addition to these officers the executive committee included: J. F. Kieghtly, Great Lakes Engineering Co.; T. F. Meek, Detroit Steel Castings Co.; W. F. Putnam, Detroit Testing Laboratory. At the time of election, W. M. Corse was connected with the Detroit Lubricating Co., and was secretary of the Brass Founders division of the American Foundrymen's association. J. J. Wilson was foundry superintendent for the Cadillac Motor Car Co., and later for many years general foundry manager for the General Motors Corp. A. H. Waterfall at the time of the election connected with the Russell Wheel & Foundry Co., soon after assumed a prominent position with the Dodge Bros. Co., in the manufacture of automobiles.

Detroit Entertains 1910 Convention

Growing importance of the automobile industry and the extent to which it centered in lower Michigan was one of the leading factors which induced the A. F. A. to select Detroit as a convention city in 1910. The Detroit Foundrymen's association, which included nearly all the foundries in the vicinity in its membership, played an active part in the preparation and conduct of the 1910 convention and exhibition. Officers of the period included: President, Arthur T. Waterfall; vice president, Joseph J. Wilson; secretary, A. Preston Henry; treasurer, E. I. Chase; members of the executive board, F. F.

Beall, W. M. Corse, Frank McMurdie, Melvin Henry.

To handle the convention and exhibition the Detroit foundrymen set up the following organization: Chairman, Frank T. F. Stephenson; secretary, A. Preston Henry. Chairmen of the various committees included: Finance, Frederic B. Stevens; plant visitation, Joseph J. Wilson; reception, James S. Keightley; convention, sessions, W. P. Putnam; ladies, DeLaMotte Henry; entertainment, Edward J. Woodson; boat ride, Oliver Phelps.

International Congress in 1926

Many of the considerations which induced the American Foundrymen's association to hold the 1910 convention and exhibition in Detroit again were responsible for bringing the International Foundry congress there in 1926. In view of the magnitude of the undertaking and the anticipated large crowd of visitors, the Detroit foundrymen extended themselves in 1926 and carried through an elaborate program in a highly creditable manner. Robert G. Crawford, president of the Atlas Foundry Co., who died Nov. 22, 1931, was chairman of the executive committee. From its inception Mr. Crawford had been one of the most energetic and enthusiastic members of the D. F. A. and served as president for three consecutive terms, 1924-27.

Chairmen of other committees included: Finance, Jesse D. Stoddard, Detroit Testing Laboratory; entertainment, W. J. Cluff, Frederic B. Stevens, Inc.; plant visitation, H. M. Lane, H. M. Lane Co.; hotel, W. J. Muhlitner, Great Lakes Foundry Sand Co.; publicity, J. J. Boland, Griffin Wheel Co.; transportation, W. R. Thompson, Warner R. Thompson Co.; reception, Chester M. Culver, Employers association of Detroit; golf, Fred Erb, Erb-Joyce Foundry Co.

Separate committees were organized to take care of the large number of ladies who attended that convention. J. L. Mahon, American Car & Foundry Co., was general chairman, and Mrs. Lucia V. Grimes vice chairman of that committee. Individual committee chairmen included: Registration, Mrs. Fred Erb; shopping guides and information, Mrs. Warner R. Thompson; transportation, Mrs. K. C. Babo; entertainment, Mrs. R. F. Flinterman, Mrs. S. W. Utley, Mrs. John Co. Woodison; souvenirs, Mrs. J. J. Boland.

For over 20 years the Detroit Foundrymen's association has exerted a far reaching influence in the foundry industry. A glance at its membership and lists of officers shows men prominently identified with advances that have been made in the ferrous and nonferrous branches of the art of casting in metals. Through one reason or another majority of FOUNDRY readers will recognize many, perhaps all of those who have served as president of the Detroit Foundrymen's association from 1907 up to the present: Frank Meek, Detroit Steel Castings Co., 1907-08; J. J. Wilson, Cadillac Motor Car Co., 1908-09; A. T. Waterfall, Russell Wheel & Foundry Co., 1909-10; W. M. Corse, Detroit Lubricator Co., 1910-11; C. H. Gifford, American Blower Co., 1911-12; W. P. Putnam, Detroit Testing Laboratory, 1912-13; R. B. Carolin, R. B. Carolin Foundry Co., 1913-14; A. Blackwood, Michigan Steel Castings Co., 1914-16; E. R. Horne, Packard Motor Car Co., 1916-17; John W. Collins, United States Aluminum Co., 1917-18; E. I. Chase, Cadillac Motor Car Co., 1918-19; H. M. Lane, H. M. Lane Co., 1919-20; Fred Erb, Packard Motor Car Co., 1920-23; K. C. Babo, Dodge Bros., 1923-24; R. G. Crawford, Atlas Foundry Co., 1924-27; J. J. Boland, Griffin Wheel Co., 1927-29; R. M. Scott, Packard Motor Car Co., 1929-30; J. L. Mahon, American Car & Foundry Co., 1930-32.

In recent years two members of the Detroit association have served as president of the A. F. A., S. W. Utley, Detroit Steel Castings Co., in 1927 and 1928, and Fred Erb, Erb-Joyce Foundry Co., in 1929.

Fred A. Cowen, Hickman, Williams & Co., treasurer of Detroit association

Peter W. Mulder, Almont Mfg. Co., Imlay City, Mich., vice president of the Detroit group

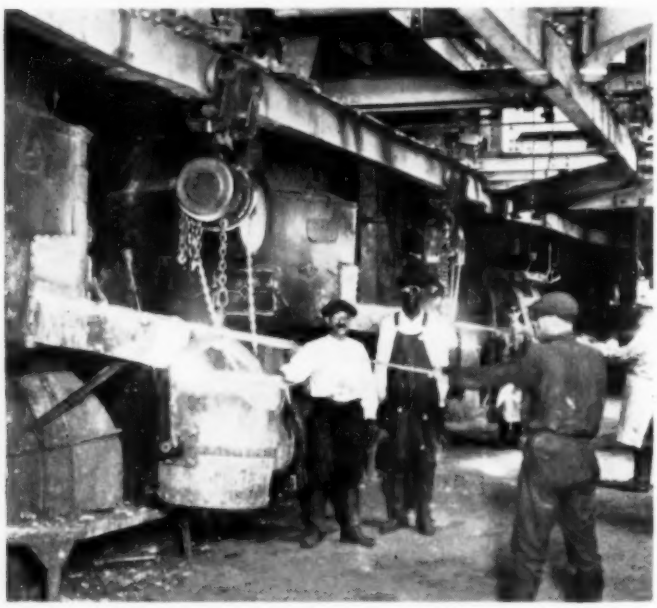
Detroit Is a Great Foundry Center

Early demand for sawmill machinery and marine castings brings shops to city

FOUNDRIES of Detroit are not solely responsible for the marvelous development of the city, but they have contributed their full share to a program that has carried the city past 10 other large American cities in a race for commercial and industrial supremacy during the past 30 years. Thirty-two years ago, in 1900, Baltimore Boston, Buffalo, Cincinnati, Cleveland, Milwaukee, New Orleans, Pittsburgh, St. Louis, and San Francisco, outranked Detroit in population. Today, with an estimated population of 1,750,000, Detroit stands the fourth largest city in the United States.

Doing Business for Long Periods

According to the 1931 edition of *Penton's Foundry List*, Detroit also occupies fourth highest place among cities in the United States and Canada, with a total number of 109 foundries within the corporate limits. Naturally, many of these foundries are comparatively new, a considerable number have been doing business for periods ranging from 10 to 20 years and a surprisingly large number have been in existence for 50 years or even greater periods of time.



Tapping two of the many cupolas employed at the foundry of the Ford Motor Co.

Detroit first rose to prominence as a great saw mill town and the outlet for all the lumber from the lower peninsula of Michigan. The first foundries were all of the general jobbing variety specializing to some extent in saw mill and marine work and later going into the production of railroad castings.

Interesting evidence of the different industrial periods was disclosed in the excavation for the new foundry of the Cadillac Motor Car Co., in 1925. The plant is built on a site occupied for many years by the American Car & Foundry Co., and its predecessors. The engineers expected to dig through a stratum of material made up of burned sand, slag, coke, ashes, core butts and pieces of scrap.

They were not disappointed, but the diggers were surprised when they penetrated the old foundry dump and found themselves wallowing in a bed of sawdust.

Ownership Shows Many Changes

Some of the old foundries have been torn down or burned down several times and have been rebuilt, sometimes on the old site, but occasionally elsewhere. Ownership in many instances naturaly has changed over such a long period. In some instances, ownership has passed from one group to another with formerly widely varying interests. In other instances ownership has been perpetuated through members of a family group. Interesting examples of the foregoing are presented in the history of the foundry at present operated by the American Car & Foundry Co., and the groups of stove foundries known under the titles Detroit Michigan Stove Co., and the Peninsular Stove Co.

James McMillan, John S. Newberry and a number of other men organized the Michigan Car Co., in 1864 and built a large plant at Grand Trunk Junction. The business prospered and grew to large proportions. In 1885 Col. Frank J. Hecker and Charles L. Freer organized the Peninsular Car Co., and erected a plant at Milwaukee Junction. A number of subsidiaries, the Russell Wheel & Foundry Co., Detroit Car Wheel Co., Baugh Steam Forge and the Detroit Pipe & Foundry Co., were gathered into associa-

tion and the two car companies were merged in 1892 as the Michigan-Peninsular Car Co. In 1899 the plant became part of the American Car & Foundry Corp., with head offices in New York.

Before the advent of the automobile in the early years of the present century, Detroit foundries had established quite a reputation for mass production of car wheels, other railroad castings and stoves. In this connection it is interesting to note that J. H. Whiting, veteran foundryman and founder of the Whiting Corp., Harvey Ill., was melting 300 tons of iron per day at the plant of the Detroit Car Wheel Co., in the early eighties. Many years elapsed before that feat was duplicated elsewhere.

Pioneered in Stove Making

Extensive stove manufacturing industry for which Detroit is famous owes its origin to two brothers Jeremiah and James Dwyer. Jeremiah Dwyer's career was typical of the industrial growth of the city of his adoption. It has been equalled by few and surpassed by none in rapidity of rise or in the manifestation of courage, industry and vision. A pioneer in Detroit and a moving spirit in the creation of one of the largest groups of stove manufacturing plants in the world, he died in Detroit Jan. 29, 1920.

In company with his brother James he started a small shop in Detroit in 1861. In the early days he made the stoves by day and peddled them by night to down town stores. The Civil war created a demand that greatly extended the market for stoves. With Francis Palms, M. I. Mills, Charles DuCharme, George H. Barbour and others in 1871 he founded the Michigan Stove Co., and became president of what in later years became the largest stove manufacturing company in the world. The plant buildings cover an area of 360,000 square feet and houses the activities of 1500 men. James Dwyer organized the Pensular Stove Co., in 1881.

In addition to gray iron, Detroit foundrymen have entered extensively into the production of steel, malleable iron and nonferrous castings. Although not exactly within the boundary of the city of Detroit, it may be pertinent to point to the fact that the first bessemer steel made on this side of the Atlantic was blown at Wyandotte in 1865 in a converter designed and constructed by the inventor of the process William Kelley.

Steel castings first were made in Detroit in the early nineties at the plant of the Detroit Steel & Spring Co., succeeded later by the present Detroit Steel Casting Co., under the direction of S. W. Utley. A bessemer converter served the needs of the old plant. The present plant greatly improved and extended since the present company commenced operation in 1902 is equipped with two 25-ton open hearth furnaces and one electric furnace.

Pioneering in a comparatively new field a few years ago R. F. Flinterman organized the Michigan Steel Castings Co. in 1907 and installed two electric furnaces in a plant at St. Aubin and Atwater streets for the production of light alloy and carbon steel castings.

Malleable iron castings have been made in Detroit for over 50 years by the Michigan Malleable Iron Co. A large modern shop is located in Delray, formerly a suburb on the river at the west end of the city. As with many other suburbs the wave of city expansion long since has rolled over and beyond Delray, but the name of the section still is retained for general reference purposes. The plant is equipped with 8 air furnaces and the output of castings under normal operating conditions is 100 tons per day.

Pouring station on the cylinder mold conveyor line at the Ford foundry

One of the molders at this plant posed for Frederick C. Hibbard's well known statue of *The Molder*, shown at one time or another at nearly all the art exhibitions held in this country.

Detroit Accepts Challenge

The advent of the automobile with high powered engine and mandatory demands to hold weights to a minimum presented a challenge to the foundrymen of Detroit, a challenge that was taken up and brought to a successful conclusion. Two of the largest shops in the country specializing in the production of aluminum and other nonferrous castings, principally for the automotive and air craft industry, are located in Detroit. Experimental and research work in these plants has been dissemintated throughout the entire industry.

Methods, equipment and processes developed in Detroit ferrous and nonferrous foundries have exerted a profound influence on the casting industry and are responsible to large extent for the radical changes noticeable in recent years. Physical properties and design of castings that would have been rejected as impossible of accomplishment 25 years ago, now are accepted without comment.

Fig. 1—A view of the wood patternshop showing the arrangement of the machines. The benches are placed along the windows

Patterns Rule Molding Methods

Familiarity with foundry practice is essential in patternmaking skill

BY EDWIN BREMER

NO ONE realizes quite as well as the foundryman, the importance of proper pattern equipment and the ability of the pattern maker to make patterns which facilitate rapid and economical production of castings, or which hamper production to a considerable degree. Patternmaking is a trade requiring the highest mechanical skill and those engaged in that work must have an excellent knowledge of drafting, foundry practice, mathematics, and machine shop and woodworking practice.

Pictures Finished Casting

A skilled patternmaker must be able, after reading a drawing, to picture in his mind the appearance of the finished casting. His knowledge of foundry practice should be such that he can establish parting lines that will permit rapid and economical molding methods. He should know the characteristics of steel, gray iron, malleable cast iron, and various nonferrous alloys so that the proper shrinkage allowance may be made. With that knowledge he also will be able better to suit the pattern to the alloy.

The majority of large foundries maintain pattern shops with one or more men where patterns may be constructed, kept in first-class repair, or changed to fit the particular practice in the individual foundry. Other firms, which do not operate foundries of their own but use large quantities of castings, find it advisable to maintain pattern shops to supply patterns to the foundries making their castings. In addition to those types of pattern shops, a third and extremely important class of shop is in operation.

That type is the jobbing pattern shop which

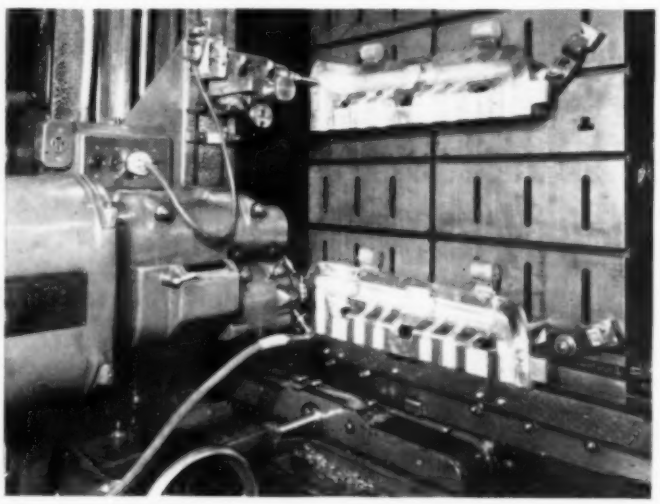


Fig. 2—Automatic machine produces duplicate patterns and coreboxes rapidly and economically. The master is mounted at the top and the duplicate is at the bottom

makes patterns for foundries or manufacturing establishments that do not operate pattern shops, produces patterns which the customer is not equipped to make himself, or supplies the additional pattern shop capacity needed in busy seasons, or when a rapid changeover is made in pattern equipment. While it may be thought that with the large number of pattern shops connected with foundries or other firms, few jobbing shops would be in operation. Nevertheless it may be surprising to many to find that three large foundry centers have about 50 jobbing pattern shops each, while a fourth has over 80 jobbing shops. The sizes of the shops vary, of course, from those employing one or two men up to those employing 25 or more.

Operates Nonferrous Casting Shop

One of the largest jobbing pattern shops in the country is the City Pattern Works, Detroit, which in the busy season has employed 200 men on day and night shifts. The firm produces both wood and metal patterns, and maintains a foundry for the production of its nonferrous metal patterns. The iron patterns are cast by gray iron foundries from master wood patterns supplied by the City Pattern Works, and returned to it for finishing. The firm occupies a combination one and two-story building designed and constructed to obtain every advantage of natural light and ventilation. The two-story portion is L-shaped about 125 feet on a side and 50 feet deep. The one-story portion housing the foundry joins the two-story unit to form a square building.

The wing at the right contains the pattern-making departments proper. The upper floor is devoted to wood and light metal patternwork while the heavy metal patterns are made on the ground floor. The upper floor of the wing forming the front of the building contains the various offices while the lower floor constitutes the receiving and shipping departments. A wide doorway permits entry of trucks for loading and unloading, and that portion of the building is separated from the remainder by suitable partitions and doorways.

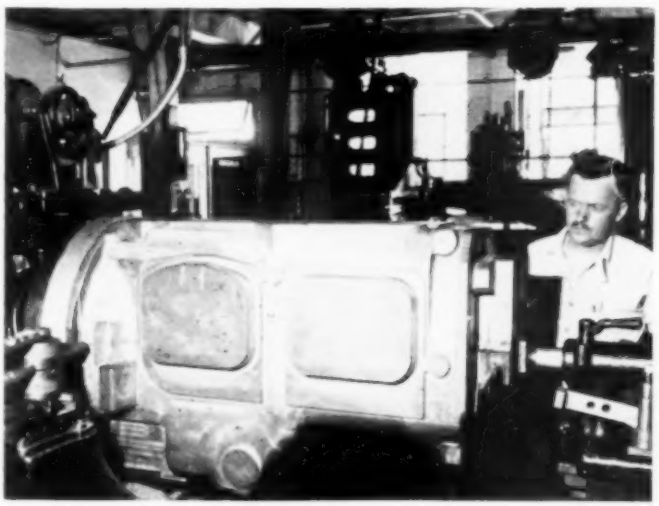


Fig. 3—Many of the patterns must be machined all over, and this illustration shows a heavy cast iron pattern in a 42-inch lathe

Fig. 4—Some milling operations are performed on a special machine with the milling head higher than usual in such machines

It is apparent from the approximate dimensions given for the pattern shop that little space is wasted, that being one of the features of the plant. All machinery is placed in the middle portion of the building with sufficient space between the various machines to allow operation without cramping. Patternmakers benches are placed along three walls under the windows. All machines are driven by individual motors as the firm has ascertained that individual drive is most economical with the necessarily intermittent operation of the various machines.

Machinery has been arranged to save steps and to that end the woodworking machines are located close to the woodworking benches and the metalworking machines in the front of the building. The machinery is of the latest type and is built substantially to handle the variety of work. Where several machines of the same kind are used, the company has found it advisable to standardize upon one make. In that way less repair parts have to be carried in stock and

Fig. 5—A group of pattern plates for relatively light castings constituting one order from a large automobile manufacturer

the various parts are interchangeable from one machine to the other.

The City Pattern Works has developed an accurate system for obtaining estimates which are submitted for pattern work. The system incorporates the use of printed forms which include every possible operation that may be performed, and piece of material down to screws and dowels which may be used in producing a complete pattern. Time estimates for performing various operations are compared with actual time costs on similar operations so that there is little chance for error.

In addition to the actual amount of materials and labor estimated, and their costs, adjoining spaces are left for insertion of the selling costs of such items, and it is those costs which are employed in submitting the final estimate. That method of estimating is employed because the firm has distributed the proportionate amounts of overhead, depreciation, etc., to the various operations. That method has been found to give a true picture of operating costs.

Layouts Made on Aluminum Sheets

Jobs received generally are in the form of blueprints made from detailed drawings which are retained in the customer's engineering department files. While the blueprints are fairly accurate, there always is a possibility that the papers will shrink or stretch due to the method of making the prints. Consequently, to insure the utmost accuracy in the final pattern, it is necessary to make a full-sized layout on some material that will retain its dimensions at all times, and withstand considerable handling.

Sheet aluminum about 1/16-inch thick, 3 feet wide and 4 feet long is used for the purpose. To relieve the strain on the eyes of the workmen, the sheets are painted with a thin coating of prussian blue, and both sides of the sheets are used. Sharp steel scribers are used as the drawing instruments, and form exceedingly sharp lines against the blue coating on the surface of the sheet. While the lines also are cut into the surface of the aluminum, the depth is slight, and in case of a mistake being made, a thin coat of prussian blue places the surface in condition to receive corrections.

Layout men are experienced patternmakers and designers who act in two capacities. One of course, is that of layout men making the detailed drawings on the aluminum sheets for the pat-

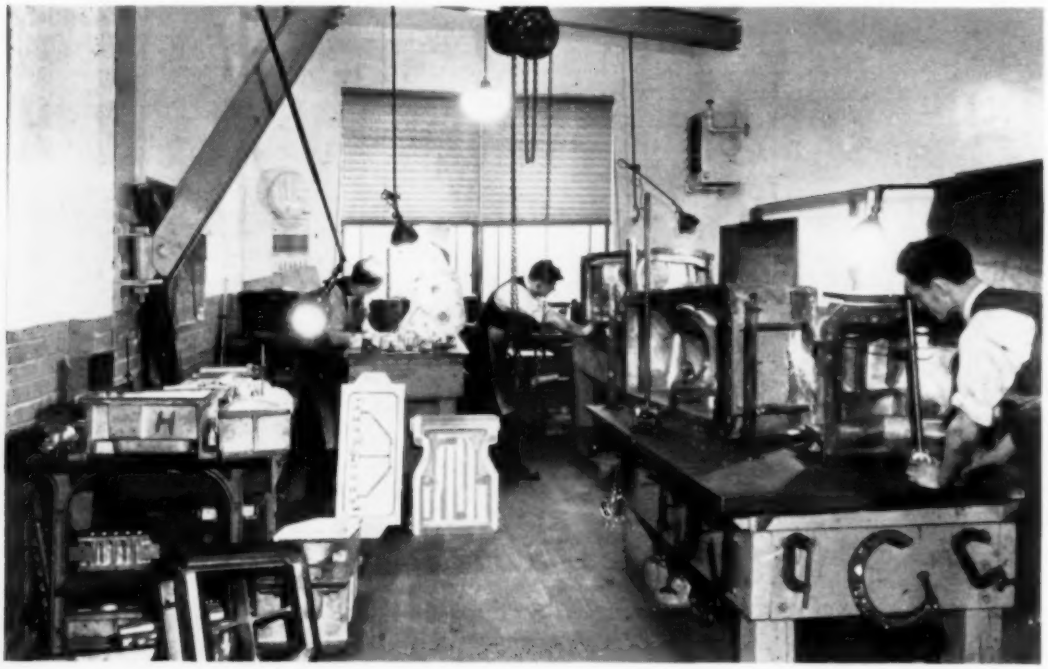


Fig. 6—Before the patterns are shipped to the customer they are inspected carefully to see that they meet the desired requirements

ternmakers. The other capacity is that of inspectors who carefully examine the finished patterns and check them back against the drawings. However, to prevent any possible chance of error, the firm has established an iron-clad rule that the same man making the layout shall not act as the inspector of the finished pattern.

By observing that rule strictly, the inspector being unfamiliar with the particular pattern in hand must of necessity refer constantly to the drawing, and in that way he will notice every deviation from the stated dimensions. If the same man made the drawings and inspected the pattern, there always is a possibility of error no matter how conscientious he may be, due to subconscious reflexes engendered by his familiarity with a particular job.

Note Deviations in Dimensions

The inspectors are supplied with pads of ruled forms containing several columns and including space at the top for the inspectors name and the job number. As he checks over the various dimensions of the pattern, he notes on the form whether it conforms to those on the drawing or varies from them, and how much. After the pattern is inspected completely, the forms with their notations are turned over to the pattern shop superintendent. He subjects them to careful scrutiny before initialling them with his final O. K. From his long experience he is able to judge when slight variations occur whether corrections are necessary or not.

In many instances particularly with intricate cored patterns, a further check is made to see that patterns and core boxes are made properly so that the desired metal thicknesses are obtained. That operation consists of making plaster molds and cores from the patterns and core boxes and assembling them. Strips of clay are placed in the mold cavity and over the core at various points. When the molds are disassembled, the clay strips show the metal thickness at those points.

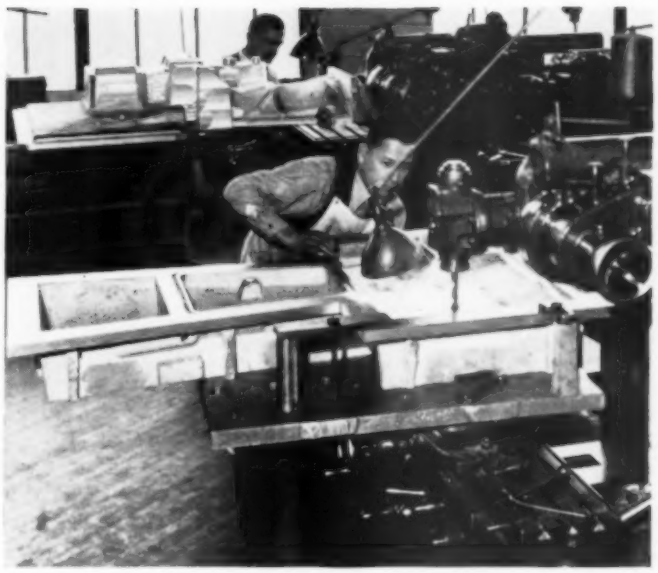


Fig. 8—Milling operations being performed on aluminum patterns for a tractor transmission cover. The one in the foreground is the drag

Some idea of the layout of the patternmaking department, and the variety of work turned out by the City Pattern Works may be obtained from the accompanying illustrations. Fig. 7 is a view of one bank of milling machines which shows 4 machines of the 14 used in the plant. It is typical of the arrangement of the machines throughout the shop in that while they are placed compactly, sufficient space is allowed around each machine so that they may be operated without interference. Fig. 1 is a view of the wood shop located in the back portion of the room. The illustration shows excellently the arrangement of the patternmaking (*Please turn to page* 78)

Fig. 7—A bank of four milling machines arranged in a row provides sufficient working space for operation without crowding

Avoiding Pitfalls in Costs

Locating the elusive normal basis upon which to measure variations is vital problem

By ALBERT E. GROVER

AN IMPORTANT consideration to every foundryman, today, is what use can be made of a cost system to guide his business out of this depression, and what steps should be taken to protect it against a recurrence of the present situation in the industry.

The whole business structure of the world is undergoing a radical adjustment which will make competition keener than ever before experienced, and the foundryman soon will be face-to-face with the problem of establishing a method of pricing his product. If he uses an unsound basis he lays himself open either to turning profitable business to his competitor, or accepting orders that will not return him a profit.

The foundry industry has its rightful place in the industrial structure of the world, and for that reason if none other, each individual operator in the industry is entitled to accumulate profits on economical operations from which investors in money and effort may be recompensed for the investment. This being true, then so long as there are periods of normal booms and depressions, costs at normal must be used.

What Is a Safe Normal?

The only safe basis to be used is standard or normal costs, in other words costs as they should be with the foundry operating at normal capacity. While this is the most important angle of good cost accounting, establishing of a standard or normal basis is most difficult.

Many normals are established from averages of past performances. This is all right if the past performances have been comparable with the present conditions. Such a basis of past performance is feasible only if the following conditions obtain:

1. Raw material prices must have been the same as prevailing today.
2. The wage rates then prevailing must have been the same as today's.
3. The volume of business was in the same ratio to the capacity of the foundry as the present expected production.

It is not intended to deprecate the importance of past records in the establishment of normal costs, but rather to impress upon the minds of the foundrymen the necessity of co-ordinating these records with the potential capacity of the foundry and the present and expected future requirements.

To illustrate the importance of clear thinking in the establishment of normal operation, take a few simple figures assumed merely for purposes of illustration and relating to the molding department. Please consider the conditions covered in Table I.

Measure Effects on Costs

With this foundation established the effect on the final costs is illustrated by allocating the principal items of burden as they would occur with the foundry operating at these various volumes of business.

It seems unimportant to go into the matter of direct materials and direct labor as foundrymen experience little difficulty in ascertaining normals on these elements of costs. The analysis shown in Table II is based upon assumed figures, but in general relationship it mirrors the principle established.

Depreciation shown in the illustration is calculated upon the reproduction value, or today's purchase price for equipment of the same utility value, of the buildings and equipment, and at rates sufficient to write off the assets over their expected life. Table III shows how the amounts were determined. The obsolescence

TABLE I.

Comparison of Molding Expenses

	Men	Days	Hrs. per Day	Total Hours	Rate	Wages
Capacity	50	300	8	120,000	0.70	$84,000
Past Performance	30	210	9	83,700	0.90	75,330
Present Performance	20	200	7	28,000	0.50	14,000
Expected Performance	40	300	8	96,000	0.70	67,200
Fair deductions for absentees, repairs, etc.	5	300	8	12,000	0.70	8,400

and wear, or depreciation, relationship are shown divided and assigned on the basis of 60 per cent of the total charged to the former and 40 per cent to the latter.

The importance of including interest on investment as a cost is clearly illustrated, as the investment in buildings and equipment exists the same in times of low production, as prevails today, as in other periods of normal or high production.

Tonnage An Unsafe Measure

Some items of cost remain constant during normal, boom and depression periods, whereas others fluctuate widely as business volumes fluctuate. These fluctuations are rarely in ratio to either tonnage produced, direct labor, or direct labor hours. Therefore it is essential to the establishment of *sound* normal costs that each kind of expense be treated separately.

The same line of reasoning is used in establishing normals for other departments as the following: Melting, coremaking, tumbling, chipping and brushing, grinding, pattern making, shipping.

It is important that there be balance between these departments. For example some foundry may have too much molding capacity for the cleaning departments and the reverse of this may exist. The cost of maintaining such excess capacity should not be considered in the establishment of normals, but charged direct to non-operating loss.

Having established these facts concerning costs with varying volumes of business, the next step is to decide which one of them shall be used in pricing the castings as orders are received. If capacity production be accepted as a correct basis upon which to cost the various items of production, the foundryman will lower the price to such a point that he will not establish a surplus sufficient to carry him over depression periods when there is no business to be had at any price and he will be forced out of business.

Past performances do not always measure the conditions that will prevail in the period when the foundryman will use his system to control his business policies, therefore these results must be tempered with expected performance.

Costs Too High—Prices Too Low

To use the present, or any other period of low production, as a basis of costing for setting selling prices is not only unfair to the customer but will most surely restrict the company's sales to only the absolutely necessary articles and if there is competition operating nearer to normal, or that bases sales on costs at normal, the company will turn away profitable business. If this policy is consistently maintained the company will need no cost system as they will be out of business.

Expected performance may be high or low as compared with the normal operation of the foundry and is dangerous to use at all times in pricing sales. Any fluctuations from normal will tend to affect the foundryman's profit situation in the same manner as just explained for past and present performance.

Capacity less 10 per cent is really capacity as this deduction meas- (*Please turn to Page* 96)

TABLE II.

Figures Assumed To Illustrate Principle

	Capacity	Past Perform.	Present Perform.	Expected Perform.	Less 10% Deduction for Absences, Repairs, etc.
Men	50	30	20	40	45
Depreciation—Buildings	1,667	1,667	1,667	1,667	1,667
Depreciation—Equipment	5,000	4,395	3,465	4,600	4,800
Taxes	1,200	1,200	1,200	1,200	1,200
Insurance	150	150	150	150	150
Interest on Investment	5,400	5,400	5,400	5,400	5,400
General Supervision	6,000	6,000	5,000	5,000	6,000
*Foremen	2,500	2,500	2,000	2,000	2,000
*Clerks	3,000	3,000	1,500	2,700	2,830
*Indirect Labor	30,000	25,000	5,100	26,000	29,000
*Heat	2,220	2,220	1,800	2,220	2,220
*Light	960	960	750	960	960
*Power	1,400	1,000	400	1,200	1,280
*Supplies	7,000	5,000	1,800	6,000	6,800
*Repairs	1,100	700	300	900	990
*Pattern and Flask Work (Sales excluded)	7,500	4,500	1,650	6,500	7,050
*Accident Expense	1,500	900	300	1,200	1,350
*Defective work	8,000	4,800	1,600	6,400	7,200
*Proportion of General Expenses	14,000	12,000	5,000	13,000	13,600
Total	98,597	81,392	39,082	87,097	94,497
Cost per molding hour	0.82	0.97	1.40	0.91	0.88
Per cent of Direct Molding Labor	117	108	280	129	125
Production per man per day	?	600 lb.	700 lb.	?	?

*Fluctuating expenses varied approximately with production rate.

TABLE III.

Depreciation Factors Assumed for Analysis

	Life Rate	Prod. Hours	60% Obsolescence	40% Wear & Tear	Total Dep.
Capacity	8 yr. 12½%	120,000	$3,000	$2,000	$5,000
Past Performance		83,700	3,000	1,395	4,395
Present Performance		28,000	3,000	465	3,465
Expected Performance		96,000	3,000	1,600	4,600
Capacity less 10%		108,000	3,000	1,800	4,800

Buildings (Molding portion only) $50,000 on basis of 30 years (3 1/3%) equals $1,667 yearly.
Equipment—$40,000.

Fig. 1—The yard crane handles materials from the cars to the scales

Accurate Scheduling of Materials

Permits Caterpillar Tractor Co. to operate with low inventory and small storage space

By M. J. GREGORY

THE material yard at the foundry of the Caterpillar Tractor Co., Peoria, Ill., was designed with a minimum of space with the avowed intention of keeping inventories of raw materials as low as possible. There probably is no other material yard so small in comparison with the size of the foundry which it serves as is this one.

When one considers that the foundry is capable of casting 300 tons of metal daily, it becomes evident that all materials must be scheduled accurately. As a matter of fact, the real storage for that foundry is the material which is in transit. Low inventories are made possible by the constant check or follow-up of the purchasing department along with the vendors of the various materials utilized in the foundry.

The practice also eliminates extra handling and labor for, as is often the case, materials are used directly from the railway cars rather than being taken to the storage bins. No materials whatsoever are handled by hand.

Fig. 1 shows the crane with the lifting magnet dropping a sufficient amount of iron or briquettes into the scale hopper. All materials that go into a charge are weighed in a like manner. The scale dial is on a level with the crane cab and can be seen easily by the crane operator.

At this point it may be well to mention that it is quite remarkable how effectively the crane man can drop any part of the load from the magnet to tip the scales at any desired point. The charge is then dumped by air from this cradle scale into the charging buckets below, which move down roller conveyors to a point where they are picked up by the crane on the charging floor.

Hoppers Hold Small Amount

Coke and limestone hoppers are directly behind the cradle and have a capacity of two and one cars respectively, which is the maximum amount of that material carried in inventory at any one time. These materials are discharged through gates in the bottom of the hoppers into a charging bucket which rests on a moving scale car running directly beneath, and adjacent to the weighing cradle.

Four men charge all the metal. Their work is

distributed as follows: A crane man in material yard weighs all charges. The scale car operator dumps charges from cradle and weighs limestone and coke. A charging crane operator, and a man on the charging floor perform various duties along with watching the cupolas. These four men can handle 40 tons of materials an hour.

Fig. 1 also shows the unloading of pig iron from incoming railway cars directly into the charging unit. The surplus, after making up the charge, is dropped on the ground as the magnet returns to the car, thereby eliminated considerable extra handling. At no time are there more than three cars of pig iron in the material yard.

Turnings Pressed Into Briquettes

Fig. 2 shows the overhead crane with the lifting magnet taking borings from the tote boxes, and depositing them in the hopper over the briquetting machine. These borings and turnings are collected in tote boxes throughout the various machine shops located in the plant and are transferred to the foundry material yard on an industrial railway.

Turnings and borings move by gravity into a vibrating screen of 1 inch mesh directly over the reciprocating hopper of the briquetting machine and are then pressed into briquettes as shown in Fig. 3. Adding the briquettes to the cupola charge is accomplished by the overhead crane as previously mentioned. The percentage of briquettes used is varied with the supply, so that a large quantity never is found on hand.

Fig. 2—Borings and turnings are received on an industrial railway from the machine shop

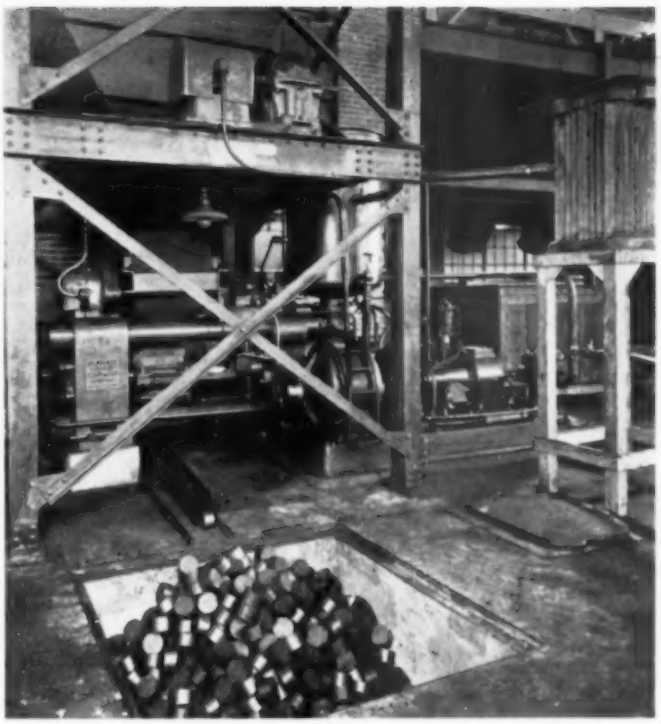


Fig. 3—The briquetting machine operates hydraulically and has a capacity of 3 tons an hour

The briquetting machine is operated hydraulically by a pump of the constant-flow type, being capable of building up a pressure of 1500 pounds per square inch and developing within the machine a pressure of 330 tons. On straight cast iron borings of a suitable nature, the machine has a capacity of 3 tons per hour. However, with mixed borings such as steel, cast iron and malleable it compresses out 2 tons per hour. The life of the die and ram varies with the materials used. The life of some dies has been as high as 208,137 briquettes, while with the other materials the life has been only 53,427 briquettes.

Materials Moved by Tractors

The material yard crane also may be equipped with a clam shell bucket for unloading silica sand into the hoppers directly over the core-sand mixing machines. Concrete bins for winter storage are shown in Fig. 2. A view of the long train of scrap material comprised of scrap steel, steel turnings, malleable and cast iron that is gathered in the various machine shops and drawn to the foundry by a Caterpillar tractor, also is illustrated in Fig. 2. An industrial railway connects the various departments of the plant and greatly facilitates the work of the tractors engaged in transferring material from one point to another in the sequence of operation essential to economic production. The small material cars are equipped with suitable coupling gear and thus may be assembled into long or short trains depending on the amount of material to be moved at any given time.

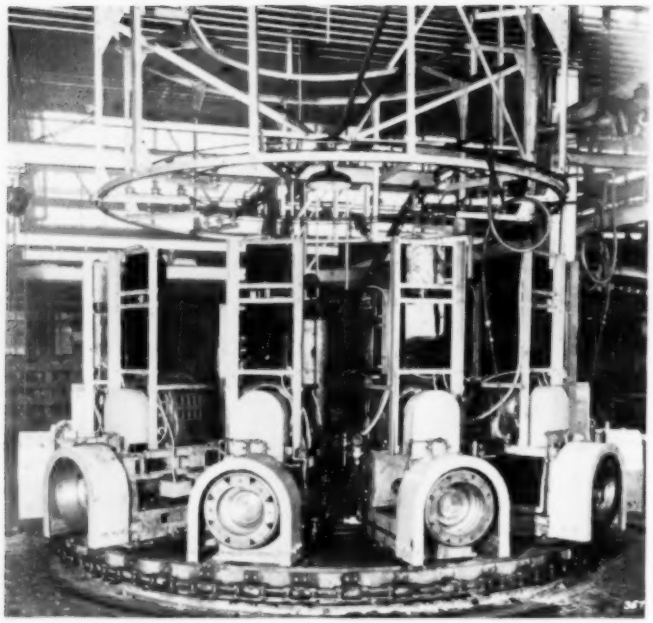


Fig. 7—A view of one of the centrifugal casting units showing the compact arrangement of the various parts

Fuse Iron to Spinning Shells

Brake drums are produced rapidly on compact centrifugal machines

NEW developments in the foundry industry often call for radical changes of ideas in production methods, specially designed equipment, and different layouts than those usually associated with the normal foundry practice. Such is the case in the manufacture of the alloyed iron lined steel brake drums developed by the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich. In the description of this firm's process presented in the March 1 issue, mention was made of the necessity of obtaining complete fusion between the lining and the drum forming the shell.

Insertion of an incandescent drum in a dry-sand or metal mold was not satisfactory as the loss of heat was such that complete fusion between the lining and the steel drum did not take place. Consequently, other methods were tried without material success until experiments were made with the centrifugal casting method.

When results showed considerable promise, the next problem was to design units that would produce the lined drums rapidly and economically. The engineering ingenuity displayed in the design and construction of the compact units for the production of the drums is such that a detailed description of one will be of interest.

Fig. 7 presents a general idea of one of the machines as it appears installed on the turntable. The circular structural iron work portion at the top is suspended from the building trusses and separate from the turntable and its equipment, and forms the support for the 3-phase electrical conductor leads supplying power to the device.

Turntable Has Twelve Segments

A rigid, hollow tube fastened to the turntable supports an arm to which three bronze trolley wheels, each insulated from the other, are attached. Insulated conductors from the trolley wheels are carried down to the base of the turntable in the hollow standard.

The turntable is composed of 12 cast segments which are 4 feet long on the outside arc, and 3 feet deep. The segments are bolted to each other and the alternate segments are bolted on the inside arc to 6 heavy, cast arms about 4 feet long radiating from a 6-sided central support block. The center support block constitutes a bearing which fits over a pivot firmly bolted to a concrete pier located in the center of the area.

By

EDWARD W. BEACH

and

EDWIN BREMER

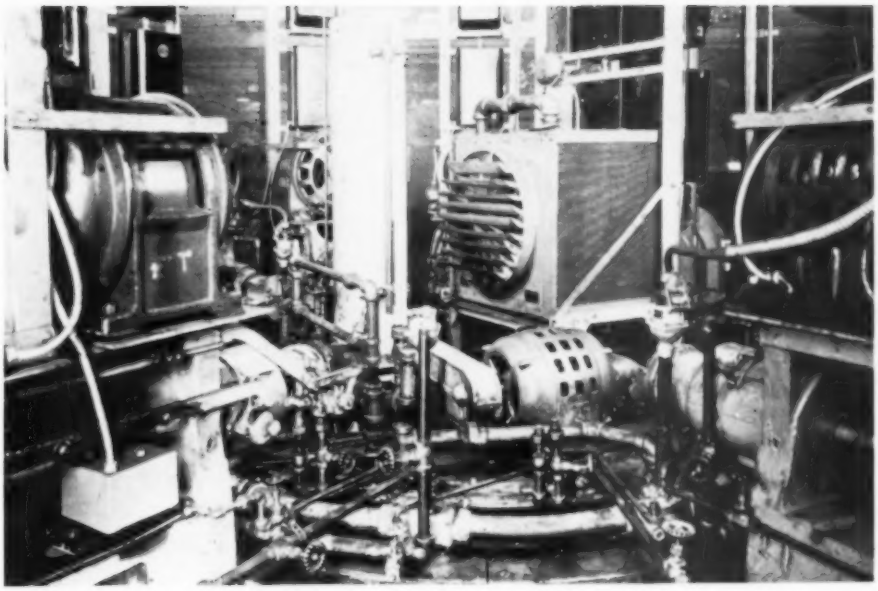


Fig. 9—While the piping system is complicated, unscrewing six unions allows a machine to be removed easily

Each segment is mounted on three wheels, two of the wheels being in the front or outside arc and one in the back giving a three-point suspension. The wheels run on two circular rails 26 inches apart. A heavy chain is fastened to the face of the outer circle formed by the segments, and is driven by a sprocket. The motive power for the sprocket is supplied by a motor placed in a pit below the floor level. It is in train with a variable speed drive so that the speed of the table may be varied from one revolution in six minutes to one revolution in two minutes.

The centrifugal casting machines are mounted on the cast segments, one machine to each segment. Open spaces over the arms connecting the segments to the central support are floored over with heavy steel plate. Oil and water piping, pumps, water cooling system, etc., are mounted in the central portion, and the oil and water reservoirs are placed beneath that section between the arms. An idea of the compact arrangement of the equipment in the center may be obtained from Figs. 8 and 9.

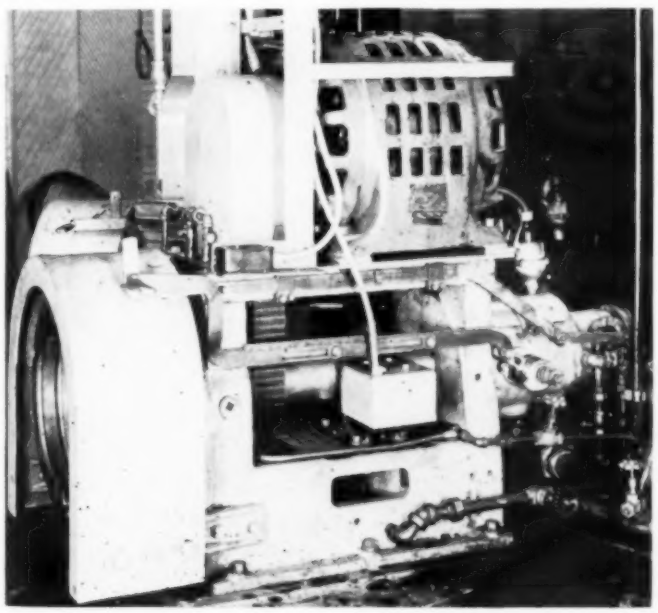


Fig. 8—The driving motor is mounted on the top of the unit

The motor shown on the floor in the center of Fig. 9 drives the oil pump through a silent chain drive. The small motor to the right, and at right angles to the oil pump motor is direct connected to the water circulating pump. The radiator with its enclosed fan shown above the motor is for cooling the water.

Pistons Are Oil-Operated

The tall tank at the left of the cooling radiator is the oil pressure tank. The water circulating system supplies water to cool the bearings on the centrifugal casting machines and the oil system serves two purposes, namely, actuating the pistons opening and closing the jaws of the chucks of the casting machines, and supplying oil under pressure for lubricating bearings of the casting machines.

Five rows of heavy pressure piping are arranged in concentric circles just outside the machinery in the center of the table. The first or inner circle is about 26 inches from the center of the table and constitutes the circulating water supply line. The next circle of pipe lying just beyond the water line is the oil return line, and the oil supply line is next.

The fourth circle of pipe shown 9 inches from the inner circle is a 2-inch conduit carrying the wires for the electrical supply, and the fifth or outer circle of pipe is the water return line. Since it would be difficult to use fittings to connect outlets to the circular piping, the pipe was bent to the proper circular form, openings were made at the desired points and the outlets were welded in place. The outlets used are standard pipe nipples. Between these nipples and the casting machines all fittings are the regulation standard equipment used in pipe fitting.

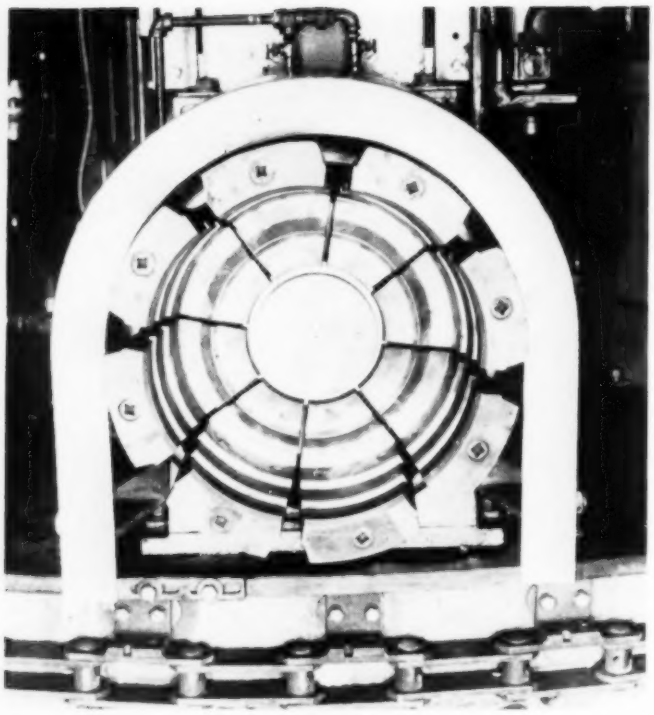


Fig. 10—A front view of the chuck in the open position showing the segmental jaws

Fig. 8 shows a side view of one of the centrifugal casting machines which are practically self-contained except for the oil and water supply lines. The machines are fastened to the segments with six bolts and the piping is so arranged that when the bolts are removed a machine may be transferred as a unit by breaking six unions which connect with the circulating systems. This permits ease in changing machines if necessary without delaying production for more than a few minutes.

Removal and replacement of machines is facilitated by the use of trucks which have the same height as the turntables. The top of the trucks contain rollers, and it is an easy matter to roll one machine from the table on one truck and replace it with one rolled from another truck.

Bearings Are Water Cooled

As may be observed in Figs. 8 and 9, the casting machine bases are integral castings. The bearing pedestals are hollow to allow the circulation of cooling water around the large ball bearings because considerable heat is conducted through the various parts of the machine from the chuck. The chuck housing shaft of the machine is mounted in ball bearings lubricated with oil under pressure, fitted and controlled by sight-feed pressure reducing oilers.

The ball races are 12 inches in diameter, carrying 2-inch balls. Motive power to revolve the chuck is supplied to the chuck shaft by a 10-horsepower motor turning at 900 revolutions per minute through a silent chain.

The chuck housing shaft which is cast integral with the housing holding the movable jaws, is 4 inches in diameter and is hollow. The head is 24 inches in diameter, and 8 inches deep. The head and housing shaft are balanced dynamically to prevent vibration. The interior face of the chuck housing is machined so that it tapers slightly from front to back. A smaller shaft 2 inches in diameter extends through the housing. The chuck shaft at the housing end terminates in a flange which operates the jaws.

The flange fits in slots at the ends of the eight segments forming the jaws of the chuck as shown in the center of Fig. 10. The other end of the shaft extending through the back bearing pedestal contains a ball bearing coupling that connects the shaft to an oil-operated piston at the back of the machine.

Clamp Drum in Place

The front end of the coupling also serves as a thrust bearing by which the yoke of the mechanical locking device is actuated. In the open position the piston is at the forward end of the cylinder, and as a consequence the opposite end of the shaft containing the flange is thrust outward. This allows the chuck jaws to slide forward in the tapered housing, thus opening the jaws and allowing a drum to be placed in position. When the oil line valve for the piston reversal is opened, the shaft is pulled backward, and as it moves back the flange at the end presses against levers attached to the jaws and causes them to contract clamping the steel shell.

The taper form of the chuck, and of those portions of the jaws resting against the chuck also form a friction clutch which causes the chuck and the jaws to revolve as a unit. While oil pressure on the piston (*Please turn to Page* 86)

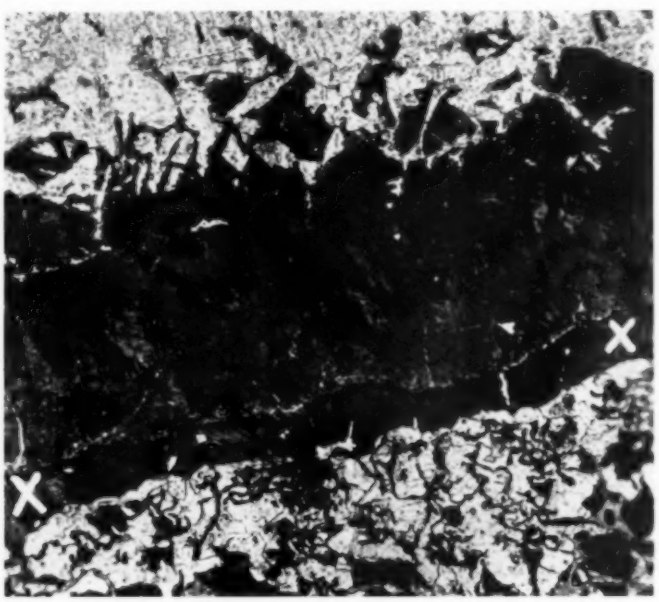


Fig. 11—Micrograph of a drum at the point of fusion marked with crosses. The portion below is cast iron while the darker portion above shows carbon penetration into the steel

A Foundry Story

Or an Experience in High Test Iron

By C. J. FREUND

Chapter I

Like many another old fashioned foundryman—and some who are not so old fashioned—Rufus Dixon ran his business pretty much himself. He made his own estimates, sold his castings, came in early enough every morning to hire what men he needed, or could get, watched his credit situation and kept his accounts straight with the help of a smart young man from an accounting firm who came in twice a week.

He was a busy man as a result and usually did not touch his mail until the noon hour. Just now he was going over the morning's pile at his old, roll top desk in the little office which had been tacked on to the front end of the glass and steel foundry building. He laid checks reverently in a drawer, thrust statements contemptuously into the clerk's tray and arranged inquiries carefully in the center of his own desk. Then he picked up great handfuls of letters and circulars which claimed wonders for core oils, furnace brick, flasks, sand, hoists and what not and stuffed them into the overflowing waste basket.

Suddenly he paused, tilted back his chair, stroked his chin and scratched his thick, short hair. His big, black eyes narrowed to slits and then dilated to a full, fierce glare. In his left hand he held a tastefully printed announcement of a two-day school for foundrymen to be held at the Municipal Institute of Technology.

Dixon believed that the rough and tumble things of life were the important things and that too much science, study and culture gradually ruined civilization.

He tossed the circular to a small, dirty desk in the corner where Mike Kolesky, his meek foreman, munched sandwiches and checked time cards with the stub of a pencil.

"This world would be a darned sight better place to live," growled Dixon, "if the professors and highbrows would tend to their knitting and teach Greek to kids in college and read Shakespeare to society dames."

Kolesky read the circular, or pretended to, and grunted. That was all he was expected to do as he never spoke. He ran the shop by nods and signs. Some of the men went so far as to say that he didn't know how to talk.

Dixon resumed his discourse. "Experience, common sense, practice, hard work, perspiration, that's what makes the foundry business go; and any other business. You ain't going to help it by putting in a lot of x, y, z, to the square root and calling it science. D'you think we can make any better gray iron here by hanging charts on the wall and covering them with red and green lines?"

Kolesky grunted again.

"A lot of fool foundrymen will run up to that school," Dixon proceeded. "How much can they learn from a schoolmaster who drinks tea and wears nose glasses?"

And once more Kolesky grunted.

Chapter II

On the second and last afternoon of the school at the Institute of Technology, the foundrymen were gathered in the physics lecture hall for the session on high test cast iron. The place was crowded. They sat in every chair, on tables and cabinets, on window sills and even on the low platform in the front of the room. They crowded the doorways and stood three deep along all the four walls.

Dixon was not there but all his competitors were, Martin of the Westland foundry, Deto and Wells of the Acme foundry, LeMarr of the National Iron Works, Crowder of the Newton Co., Pace and Avery of the South End foundry, every man who had ever underbid Dixon or had been underbid by him, was in the room.

The director of the institute rose to introduce the speaker for the hour. He waited a moment until the chatter and laughter came to an end and then began.

"Gentlemen, as I explained at the opening session, it has been our policy in this school to be as practical as possible. We have carefully avoided everything (*Please turn to Page* 77)

Titanium Aluminum Bronze

Alloy removes gases from bronze leaving only traces of titanium

BY CHARLES VICKERS

TO OBTAIN the desired homogenuity in the degasifying alloy, mentioned in the previous article which appeared in the March 1 issue, it had been necessary to melt it twice, but investigation showed good results could be obtained by making first a primary alloy which was combined with other elements to form the secondary or final alloy. The primary alloy consisted of 25 per cent titanium copper containing aproximately 6 per cent titanium; 20 per cent iron-free manganese-copper containing 30 per cent manganese; 2 per cent calcium-copper containing 50 per cent calcium; 1.25 per cent magnesium; 26.50 per cent aluminum, and 25.25 per cent copper.

Titanium-copper, manganese-copper and copper were charged together into a crucible and melted without charcoal or other flux or protective agents. Next an ingot of aluminum from the aluminum part of the charge was added and the whole stirred well. Then the calcium-copper was added with more stirring; next the remainder of the aluminum which was followed by the magnesium. The heat was mushy instead of fluid due to the influence of the titanium. Therefore, it was not possible to ingot the charge, so a heel of sufficient size to hold the entire heat was prepared from a worn out crucible, and the mushy heat dumped into it.

Making the Final Alloy

The primary alloy was allowed to solidify, and the secondary or final alloy made as follows: Fifty per cent of the primary alloy was placed in a crucible with 12.50 per cent titanium-copper, 10 per cent grade A manganese-copper, and 13.25 per cent copper, and melted. When the mixture was molten, one ingot of the 13 per cent aluminum to be incorporated in the mixture was added. Then 1.25 per cent magnesium was added and stirred in which was followed by the remainder of the aluminum. The mushy mass was stirred thoroughly, removed from the fire and dumped into a pot heel. The resulting alloy was that used for the degasifying alloy.

After a time titanium-copper no longer was made, and a manganese-titanium alloy was substituted for it. Consequently, the formula for the primary alloy became 5 per cent manganese-titanium; 8.50 per cent manganese-copper; 56.75 per cent copper; 2 per cent calcium-copper; 1.25 per cent magnesium, and 26.50 per cent aluminum. Mixing and melting the new alloy was accomplished similarly to the method previously described for making the primary alloy. Naturally, a change was made in the secondary or final alloy also, and the formula became 50 per cent of the new primary alloy; 2.50 per cent manganese-titanium; 4.25 per cent manganese-copper; 1.25 per cent magnesium; 29 per cent copper,

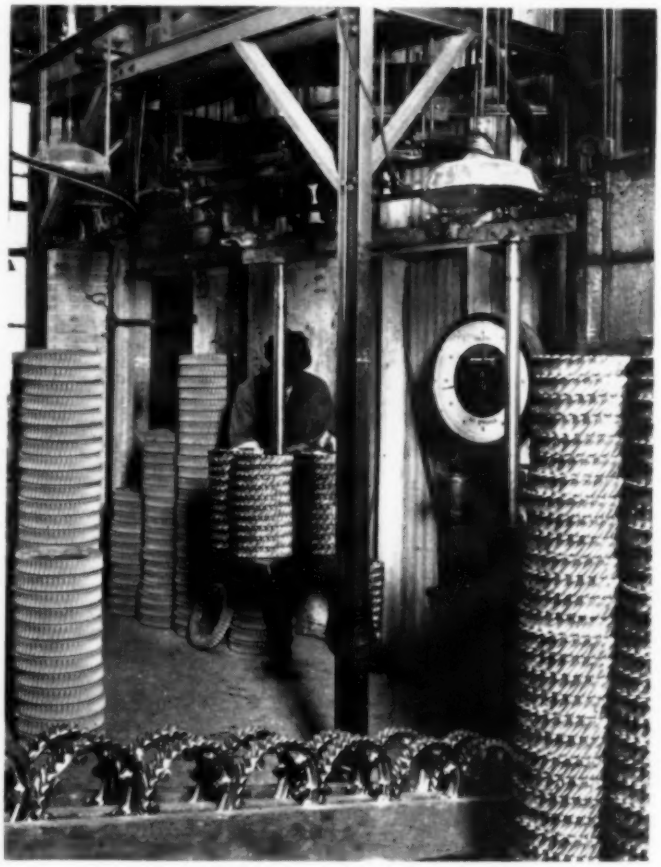


Fig. 9—A group of gears cast in aluminum and phosphor bronzes. The aluminum bronze gears are bright while those in phosphor bronze are dull

and 13 per cent aluminum. The same procedure was used in alloying as that previously mentioned for the secondary alloy. Still a little later, another change had to be made due to the fact that calcium-copper no longer was made. However, that easily was done by adding 1 per cent metallic calcium instead of 2 per cent calcium-copper, and adding the remaining 1 per cent to the copper part of the charge.

It is well known that molten aluminum bronze drosses heavily. This drossing is caused by the action of aluminum in making copper viscid. The latter in a molten condition acts exactly the same as other viscid liquids, namely it entraps air, and produces a lather resembling that on soapy water. Consequently, it is desirable that such action be checked. If that could be done, the bronze would cast like phosphor-bronze, because of its fluidity and yet would not eat into the sand of the mold.

Calcium as Lather Depresser

Addition of calcium salts, such as plaster of paris in small amount hardens water and checks the formation of foam on soapy water. Therefore it was thought possible that calcium might act in the same manner on the molten bronze. That was one reason why calcium was favored as one ingredient in the degasifier alloy.

The second reason for the addition of calcium was because of its deoxidizing power. It was believed that it might deoxidize aluminum bronze because the heats of formation of aluminum oxide and of calcium oxide per chemical equivalent are 65,340 calories and 151,900 calories respectively. Therefore, calcium is more powerful by 86,470 calories than aluminum per chemical equivalent. However, the latter does not unite with oxygen as one and one, that is as one part of oxygen to one part of aluminum but as two parts aluminum to three parts oxygen, while calcium only unites with oxygen as one and one to make lime.

Therefore, it would require three parts of calcium to remove the oxygen from two parts of aluminum when the latter was in the form of oxide, and it is doubtful whether it could do that in a mixture of copper and aluminum, containing a small proportion of aluminum oxide. Consequently, the alloy which has been described was named a degasifier and not a deoxidizer, as there is a question whether it will do the latter. For example, the author never was able to produce aluminum on decomposing aluminum oxide with calcium. If there was any aluminum present it was not identified. However metallic sodium was made readily, and identified by throwing the results of the reaction on water. A similar situation exists in regard to magnesium, but titanium and manganese are entirely out of the question.

There is a possibility that an efficient deoxidizer for aluminum bronze might be formed by a combination of the rare elements lanthanum, neodymium and praseodymium dissolved in copper as a base, as the molecule of these metals is formed the same as that of aluminum, or two parts of the metal to three of oxygen. Their heats of the formation of their oxides are all greater than that of aluminum ranging from 54,700 to 19,800 calories greater than that of aluminum oxide. Consequently, if cerium could be separated from misch metal, and the other metals were alloyed with copper, the result possibly might be helpful in casting aluminum bronze.

To obtain some idea of what effect calcium might have on copper, an alloy of 99 per cent copper and 1 per cent calcium was made and was cast in sand into bars 1.25 inches square and 6 inches long for fracture tests, and into a thin casting to determine fluidity. After pouring the sprues swelled considerably, although they poured quietly and the heads sunk down at first. The thin casting was filled with cold shuts, and the skin of the heavier casting was coated with a white substance, probably lime.

The copper was not brittle, but simply rotten, and the thin section was broken by a couple of blows. The test bar could be broken into small pieces easily. Its fracture was peculiar, apparrently consisting of two alloys. One was a salmon color which tended to segregate in the center of the bar and the other was yellow and crystalline, surrounding the salmon portion of the metal, but mixed a little therewith at the juncture.

Tenacious Film Is Formed

The outside of the casting was streaky. While pouring the metal, it seemed to be held back in coming up the riser by a tenacious film, which could be felt with the skimmer. The thin casting was porous, and the blowholes had a salmon-colored lining, although the sound part was yellow in color. Those results show the effect of one per cent of calcium in copper when cast into sand molds.

To see what would happen when aluminum was added, most of the one per cent calcium heat was remelted and 5 per cent of aluminum was added and sand castings were made as before. That resulted in an alloy bearing no resemblance to aluminum bronze. The color was dead brown, the metal rotten, the fracture of castings was full of oxides, and it was also porous, with the holes extending to the surface. The upper part of the casting was a mass of cold shuts caused by a tenacious film of oxide folded in. Consequently, it was decided that one per cent of calcium is entirely too much for copper, or copper-aluminum alloys.

As a further experiment an addition of magnesium next was made to the copper-calcium-aluminum alloy and that resulted in quite an improvement both (*Please turn to Page* 82)

United States Navy

Uses Anchor Chain

Made of Steel Castings

By Rear Admiral George H. Rock

ALTHOUGH the first patent for iron chain was granted to Philip White in 1634, hemp cable continued to be supplied to naval ships until the early part of the nineteenth century. The service rendered in more recent years by wrought iron chain on naval vessels was not always satisfactory, but it continued as the standard type for naval vessels for more than a century. Until about 1914 the wrought iron anchor chain for U. S. naval vessels was manufactured by hand.

As the size of naval vessels increased with consequent requirements for larger anchor chain, difficulty of thoroughly welding the large chain by hand so increased as to necessitate development of a satisfactory substitute process. After considerable experimental work, a steam-hammer method of welding was perfected at the Boston navy yard and, subsequently, all wrought iron navy chain of the larger sizes was manufactured under power hammers.

In 1915 increasing failures of chain occurred on U. S. naval vessels. Commanding officers' reports described these failures as being inexplicable, as they occurred under conditions involving no heavy or unusual strain. In 1916, relief from these losses was sought by periodic annealing, proofing and inspection of all anchor chain cable.

The productive capacity of the chain industry never has been great. War expansion of shipbuilding so increased the demand for anchor chain that early in 1917 it became apparent facilities and experienced personnel for producing welded iron anchor chain by hand, machine or electric welding were inadequate to meet war requirements. It was obvious that any process for making anchor chain which would make a real reduction in the amount of skilled labor required must be a radical change from the conventional methods then in vogue which required starting with the pig iron, melting down, puddling, squeezing, rolling ingots into bars, cutting bars, bending links, scarfing for the welds, welding and inserting studs. For each of these operations heating was necessary.

Fig. 1—Single links are cast in advance and are assembled in cores for producing a connected steel anchor chain

Investigate Casting of Chain

These conditions led to the investigation of the possibility of casting chain, it being recognized that that method would eliminate practically all types of skilled labor formerly employed in chain making. Chain had been cast prior to that date, but was not considered sufficiently reliable to withstand the shocks and stresses to which an anchor cable is subjected.

The General Electric Co. and the National Malleable & Steel Castings Co., among others, proceeded with the work of developing cast steel chain. A type was developed by the General Electric Co. which had ductile qualities approximating those of wrought iron chain and with a considerably higher ultimate strength. The General Electric Co. assumed that the highly ductile wrought iron had been a satisfactory material and that it would find a more sympathetic interest in chain having some approximation of the qualities of wrought iron chain than in one the physical characteristics of which differed radically.

The National Malleable & Steel Castings Co. had for some time been engaged in the manufacture of car coupler knuckles and saw the resemblance between the shock and buff that the knuckles were required to withstand in hauling long trains of freight cars and the shock and stress to which anchor chain cable was subjected. That company offered cast steel chain samples manufactured of the same grade of steel as that used (*Please turn to Page* 80)

Must Correlate Castings Design And Foundry Practice

By ALEX TAUB

ENGINEERING in terms of pure research sometimes may be separated from economics, but as applied to a product, engineering is merely the mechanizing of economics. Before a product is ready for manufacture it must include many economic considerations, the most outstanding yet most often neglected being that branch represented by the foundry. Designers have been notorious for their neglect of foundry consideration, and it is with the hope of improving these conditions that the following generalizatons are presented.

The fundamental that must be borne in mind in correlating design and foundry is the universal law of *result per dollar*. To meet competitive conditions prevailing today, product change must be considered from the angle of progress. Is the change that is being contemplated an improved result? Will this result cost more than the improvement can be worth? Is it possible to obtain the desired result for the prevailing cost, or by simplification can the desired result be obtained with a lower cost?

Consider Specific Practice

The following considerations are in the spirit of *result per dollar*. On new products or new designs consideration must be given, not only to known foundry practice, but to specific foundry practice available to the particular designer. Foundry practices vary. Some large companies readily will consider the greensanding of every possible part of a job, particularly if they are short of core oven space. Other foundries that have an abundance of core oven space will not give much consideration to green sand coring.

The designer must bear in mind that a casting, particularly such castings as automobile cylinder blocks, virtually are being assembled in the liquid state within the mold. The principle of liquid assembly must ever be borne in mind in the shaping of the design to insure that unnecessary projections, uneven sections, and uneconomic bulk shall be avoided.

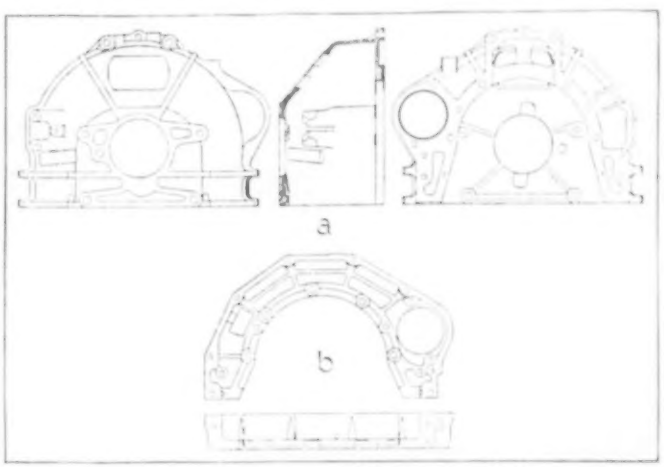
It would seem a simple proposition, with the principle of liquid assembly in mind, to arrive at the maximum in economics if one arranges to assemble in the mold the maximum amount of material, including all brackets possible that are now being bolted on. The fallacy of this argument is obvious when one considers that quite often the inclusion of a bracket in a cylinder block casting easily may raise the price per pound of the entire block. Increasing the price per pound of a block weighing 200 pounds becomes serious.

An Institution Using the Sciences

The designer does not always comprehend the foundry as an institution housing and using the sciences. It seems to be difficult for some engineers to get away from the idea that a foundry is a place where commercial mud-pie making is going on.

One does not expect a designer to be a foundry expert, since the foundry art is a lifetime's study. However, he is expected to know approximately how his casting should be made so that his design may not create unnecessary cost-producing hazards. At least his design should incorporate the proper draft considerations and the fewest possible external cores. External cores are the first sign of design weakness. They must be tolerated where necessary, but forever remain a red-flag point to be eliminated at the first opportunity.

Open-mindedness on (*Please turn to Page* 88)



The new design required for the housing is shown at A and the former design at B

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the following advisory staff: Steel, John Howe Hall; Malleable, H. A. Schwartz; Gray Iron, John W. Bolton; Nonferrous, Charles Vickers.

Aluminum Bronze Should Be Plated Previous to Soldering

Can you give us any information on how ordinary solder can be made to stick to aluminum bronze? Also can aluminum bronze castings be plated successfully with nickel and chromium?

Aluminum bronze may be soldered if it first is copper plated. No difficulty will occur as the solder which should be half and half, will adhere to the copper coating. We believe that you should not have any difficulty in obtaining good nickel and chromium coatings if the aluminum bronze first is plated with copper as mentioned for soldering. A copper cyanide bath will produce a fine-grained copper deposit. Such a deposit when buffed helps to fill up any small holes in the deposit, and will form an excellent base for either nickel or chromium.

Parting Compounds Will Prevent Sand Sticking Down

What is the function of parting compounds, and what are they composed of?

Parting compounds are finely divided materials which possess the property of shedding water. They are used in molding to prevent sand sticking to itself, for example at the joint or parting line between two sand faces, or upon the pattern. Only a thin layer of the compound shaken from a bag is necessary. The original parting compound which is used only to a slight extent today, is lycopodium obtained from a fungus growth. It is excellent for the purpose, but due to the limited amount available its price is high.

A variety of materials are used to replace lycopodium, including fine silica sand, *beam dust*, fine charcoal or coke dust, and manufactured parting compounds. The first mentioned materials only are employed where an occasional use is necessary. Manufactured parting may be obtained from foundry supply houses listed in the advertising pages of The Foundry. It is made by compounding tripoli, a species of silica, and tallow. The fine silica sand may be obtained from spent sandblast sand. Beam dust is the fine dust that has been deposited on the foundry roof beams, etc. Charcoal and coke dust may be obtained by grinding still finer, the breeze from those materials.

Gray Iron Pistons Are Cracked by Cores Being Hard

One of the subjects for discussion at a recent foundrymen's meeting dealt with the cause of fine cracks in the skirt of automobile pistons cast from a semisteel mixture. Mentally reviewing the many solutions offered I do not believe that changing the iron mixture, the gates, the cores, or cleaning the castings by other means than tumbling, would prevent the castings from cracking. I shall appreciate an expression of opinion from you on this subject.

A crack in the skirt of a light piston of the automotive type is due to one of two causes: Cold metal or a hard core. Careful examination of the crack under a microscope or even under a sharp and critical eye, will indicate which of these factors is responsible. If the crack shows a ragged fracture and the faces are separated from each other, it may be accepted as evidence that the core prevented the casting from contracting normally. If the opposing faces of the crack are smooth and jammed tightly together, it is apparent that the natural contraction of the metal was not prevented but that meeting streams of metal did not unite and amalgamate. They were separated by a thin film or skin developed by the metal in its passage through the cold mold from its point of entry at the gate to

the thin section forming the skirt of the casting.

The remedy for the first form of defect is a core which will allow the metal to contract normally. If a green sand core is adopted to replace one formerly made in dry sand, the temperature of the iron may have to be raised to compensate for the extra cooling effect of the green sand. Otherwise the character of the defect may be changed, but the net result will be the same as before. The remedy for the second cause, the cold shut, is extremely hot iron and a gating system that will admit the iron in a minimum period of time. Whether the castings are poured open end up or open end down, the gates should deliver metal direct to the skirt of the casting.

Improve Steel Strength By Small Vanadium Additions

In an article entitled "Clean Iron and Steel with Alloying Agents," by R. C. Good in the Jan. 15 issue of THE FOUNDRY, we noticed a reference to vanadium as a scavenger. Can you give us any information how it is used; whether it can be added in the ladle or not; the amount used, and its melting temperature?

Vanadium in ordinary steel is used in the form of a ferroalloy which may be obtained from advertisers in THE FOUNDRY which will supply full information on the best methods of using it. The ferroalloy may be used either in the ladle or in the furnace, and generally enough is used to give a vanadium content of 0.20 per cent, or slightly under, in the steel.

In addition to its action as a scavenger, vanadium is a valuable alloy addition to steel. In cast steel the presence of 0.20 per cent vanadium results in a considerable increase in tensile strength and yield point, with little if any, decrease in elongation and reduction of area. In this respect vanadium behaves in a manner similar to nickel. Its action is due, at least in part, to the fact that it produces a finer grain in the steel.

Casting Aluminum Fins Onto Steel Tubes Not Advised

One of our customers wants us to cast aluminum disks on steel pipe. The steel pipe is 6 feet long and there are 18 fins cast to every foot. The fins are light and the castings are to be a part of a cooling system. We would like to get your advice in regard to making the most perfect job.

We would never attempt to cast these fins on the steel pipe as we believe it would not be a success. Our idea would be to cast the disks separately and place them over the pipe. They can be machined on the joint faces and a perfect job made without any particular loss. In fact the steel pipe could be omitted, and the disks could be attached to one another by pressing them onto ferrules or tapped inside and joined together with threaded nipples in the same manner in which the sections of a radiator are assembled. There are numerous methods by which the fins can be attached, but casting them on a steel pipe would be a poor and expensive way in our opinion.

Sandblast Nozzles Must Resist Abrasive Material Wear

Can you suggest a simple method whereby ordinary iron containing 2.4 per cent silicon, 0.6 per cent manganese, 0.60 per cent phosphorus, and 0.08 per cent sulphur may be adjusted suitably for pouring into sandblast nozzles? Also, we have difficulty in making cores from $\frac{1}{8}$ to $\frac{1}{16}$-inch in diameter from sand and linseed oil. How can we keep them from breaking?

The iron you are making hardly can be made suitable for sandblast nozzles as it is much too soft. You might try the addition of 1 per cent chromium but we believe the iron will not be sufficiently abrasion proof for the nozzles. It is suggested that you wait until the end of the regular heat, and then put a special mixture in the cupola that will give a silicon content around 1.50 per cent. That may be accomplished by using considerable steel scrap in the charge. Make a ladle addition of about 1 per cent chromium. Since the charge will be melted rapidly and hot, you should have no difficulty. It will not be necessary to make a full sized charge.

The cores mentioned hardly can be made sat-

"Pouring," a photograph by Margaret Bourke-White contained in a beautiful brochure issued by the Ludlum Steel Co., Watervliet, N. Y., commemorating its seventy-fifth anniversary

isfactorily. If they are round, it may be possible to use wires dipped in linseed oil, and then rolled in fine silica sand like sandblast dust. They are baked similar to cores and used. Such cores sometimes are employed in nonferrous work, and may prove suitable in light castings. We would hesitate to use such cores in work that is medium or heavy due to the possibility of fusing the wires, core sand and metal together. If thin flat cores are desired, as are used in split hub pulleys, etc., you may use a thin piece of sheet metal coated with graphite or with sandblast dust. Bake well after coating.

Wax Process Used For Statuary Molding

A brief description of the lost wax process on page 9 of the Oct. 15, 1931, issue of THE FOUNDRY prompts us to inquire if you have had other articles on the subject. We shall appreciate a list of references.

The brief article on the lost wax process in the Oct. 15, 1931, issue of THE FOUNDRY, contained two references to articles on the same subject. One was in the July 1, 1924, issue on page 497 and perhaps is the best description of the method to be found. It deals in detail with all the steps in the production of a pattern, mold and casting of a full size human figure. Other articles on the same subject include description of the production of the *Gloucester Fisherman*, April 1, 1927, page 259; heroic *Marquette* group June 1, 1927, page 418; production of a bust Oct. 15, 1928, page 855; *The Pioneer Woman*, Nov. 1, 1928, page 866; *Illinois Alma Mater* group, Feb. 1, 1930, page 112.

Bronze Patina Is Formed Chemically

We have some bronze tablets to cast and understand that a different finish is used on the tablet for inside work than is used on tablets that are placed outside. Will you please advise if that is the case and what methods are followed to obtain the two finishes. What you would consider the proper analysis of bronze, that would be satisfactory for those two classes of work?

Usually bronze tablets are colored brown and to obtain this color it is first necessary to cleanse the tablet thoroughly and then apply a paste of 3 parts verdegris, 3 parts of ferric oxide; 1 part of salammoniac and vinegar. Upon heating the tablet it then turns black. Next it is washed and dried. Addition of blue vitrol turns the color to chestnut brown.

In a second method, brush to dryness with a hot solution of one part saltpeter, one part of common salt, 2 parts ammonium chloride with one part liquid ammonia in 95 parts of vinegar. Also a strong solution of common lye heated, will color a nice brown when brushed to dryness on the plaque. We have never noted any difference between outside and inside work so we believe the same results can be obtained by either finish. A suitable alloy is 89 per cent copper; 5 per cent tin; 5 per cent zinc, and 1 per cent lead.

Silicon Content Causes Coarse Structure

We are forwarding for your inspection a gray iron disk 1-inch thick, 10 inches in diameter with a small boss 3 inches diameter and 1-inch thick in the center. The face of the boss is chilled in the drag and the entire surface of the casting is machined. We shall appreciate your opinion on the cause of the unsatisfactory appearance of the surface.

The coarse and speckled face on the casting is due to the composition of the iron. Silicon content is too high and as a consequence most of the carbon is in the free or graphitic condition. You can check this by noting the difference in appearance between the boss face cast against a chill, and the remaining surfaces cast against the sand. The chill, or more properly speaking, the densener, converted some of the carbon into the combined form, hence the fine, close grain in that particular vicinity.

The obvious remedy is to reduce the silicon content in your mixture and thus automatically readjust the proportions of free and combined carbon. This may be done by replacing a certain amount of pig iron with steel scrap, malleable scrap or chilled, that is white iron scrap. The exact amount will be governed by local conditions. A heavy feed and a dull tool in the machine shop sometimes produces a rough surface on a casting that conceivably might come out smooth and shining from under a light feed and a sharp tool.

Area of Tuyeres Should Be Increased

We have a cupola 20 inches inside diameter in which the tuyeres are 24 inches from the bottom plate. The 4 tuyeres are made by leaving 3 x 3-inch holes in the lining, and we believe we are losing considerable wind between the brick and the shell. What should be the correct height of the tuyeres, the size and number of tuyeres, correct height of coke bed, size of iron and coke charges?

A cupola lined to 20 inches will melt approximately 1000 pounds an hour. The iron charges should weigh 250 pounds with 25-pound coke splits between charges. The tuyere area for a small cupola should be at least one-fourth the area of the cupola, and therefore, the present ones give about one-half the required area. It is suggested that you install four tuyeres 3 x 6 inches.

The distance between the bottom plate and the tuyeres is regulated by the amount of iron you wish to carry in the well or reservoir of the cupola. However, it appears to us that a distance of 24 inches is altogether too much. Allowing 4 inches for the sand bed, the present well will hold over 1700 pounds of iron. It is suggested that you reduce the height to about 12 inches. Allowing 4 inches for the sand bottom, the well will hold around 700 pounds of iron. The coke bed should extend at least 24 inches above the tops of the tuyeres, and perhaps you may find that a 30 or 36-inch bed will work better.

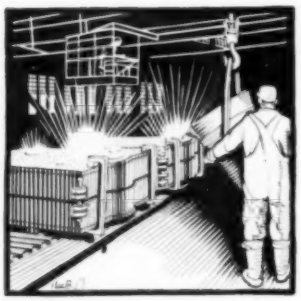
Always place the coke bed by measurement so that after the proper bed height has been determined, it can be maintained at that point. The coke splits should be weighed or at least placed in a suitable container which with its charge of coke can be checked from time to time. With a melting rate of 1000 pounds per hour and 25-pound coke splits the blower or fan should supply about 220 cubic feet of air per minute.

Lead Segregation Prevented by Sulphur

We are endeavoring to cast a cylindrical shaped casting 10 inches long, 12 inches outside diameter and 9½ inches inside diameter in an alloy composed of 60 per cent copper and not less than 40 per cent lead. Can you tell us how to accomplish this?

One method of keeping the lead in the alloy is to employ a flux composed of 80 per cent plaster of paris, 10 per cent soda ash, 5 per cent common salt, and 5 per cent borax. Use about 2 per cent of the metal weight; adding one-half with the cold metal and one-half about 10 minutes before the metal is ready to be poured into the molds. If any of the lead drops, make a further addition of about 2 ounces of roll sulphur at the mold side. Do not pour the metal cool. Experienced casters of high lead alloys protect the molds before pouring by coating them with red talc or some such material. The coating is necessary on the sand because lead and silica may react to form defective castings.

Viewing Foundry Developments



At Short Range

THE new Ford car is reported to have 40 pounds more malleable castings in it than the model A. Experimental tests upon malleable castings have been made in the Ford and other testing laboratories for the past four or five months. It has been found that malleable castings have more utilitarian value than stampings and forgings for front brake drums and differential housing. Cast iron rear drums add to the poundage of castings in the chassis; cast aluminum crankcase and cover unit; gray iron V-eight block, manifolds and water line fittings show Ford casting's consciousness in the motor.

♦ ♦ ♦

Steel foundrymen using oil-fired open hearths sometimes are troubled with high sulphur even when low sulphur scrap is used. In such cases it is wise to examine the limestone and fuel oil for sulphur. It has been found when high sulphur difficulties are encountered that either the limestone or the oil, or both, is high in sulphur.

♦ ♦ ♦

Molybdenum as an alloying agent is receiving close attention in many foundries for a variety of purposes. One automotive foundry uses molybdenum in cast-iron brake drums and clutch plates. Others use it in iron for cylinder heads and cylinder blocks. The amount varies from 0.35 to 0.50 per cent. One firm making dies for stamping steel uses from 1 to 1.50 per cent molybdenum to increase die life. Another uses iron containing molybdenum for stoker grates, and it is said with excellent results.

♦ ♦ ♦

ONE well informed authority on gray iron metallurgy states that no less than 130 foundries now are making gray iron showing a tensile strength from 38,000 to 50,000 pounds per square inch and of this number fully one-fourth consistently produce iron ranging around 50,000 pounds per square inch tensile strength. Some of these foundries make exceptionally thin castings with the higher strength properties.

♦ ♦ ♦

An English firm has developed an electrically operated molding machine employing a solenoid to perform the squeezing operation. That principle eliminates the use of a motor, air or hydraulic pipe lines, and it is claimed that with an 18 x 27-inch flask, 30 molds per hour can be produced. With electricity at 2 cents a kilowatt-hour, the cost is said to be 3 cents for 8 hours' operation.

♦ ♦ ♦

Various factors indicate that the farmer is finding a greater use for Old Dobbin for certain types of work. This change in the source of power is reflected in production schedules for industries specializing in agricultural equipment. For example, a manufacturer in the central west recently put through an order of agricultural hay tools which are to be horse drawn.

♦ ♦ ♦

ONE foundry using an indirect arc, rotating type electric furnace claims that it has eliminated trouble previously encountered from the contamination of soft gray iron heats by previous alloy heats through the use of plastic sillmanite lining. The higher cost of the latter is negligible as the linings are said to last longer; less labor is required to install it in the furnace; patching is easier; and the linings do not absorb any alloys from the heats.

♦ ♦ ♦

A manufacturer of die casting machines uses goose necks and pots made of gray iron containing small amounts of chromium and nickel. The analysis shows 2.20 per cent silicon, 0.076 per cent sulphur, 0.93 per cent manganese, 0.14 per cent phosphorus, 0.20 per cent chromium, and 0.10 per cent nickel.

♦ ♦ ♦

Various types of corrosion resistant alloy steels introduce new problems. Attainment of exceptionally low carbon ranges has been a factor in the use of induction type furnaces. One manufacturer has built, under license, a 3000-pound unit capable of melting down a heat in about an hour. Coupled in the same transformer line with this furnace are two smaller units of 1500 pounds each, giving flexibility under varying metal requirements.

♦ ♦ ♦

INTRODUCTION of simple straight lines and simplification of design has led to reclaiming certain valve castings from the forging field. Similarly, in the newer developments of special alloys such as those in the range of 25 chromium, 12 nickel and with the carbon below 15 per cent, long flattened fillets between the thin valve body and thicker flanges has conquered the shrinkage bugaboo.

♦ ♦ ♦

Some months ago it appeared as if cupronickel was destined to supersede all other alloys for condenser tubes, both afloat and for land power stations. This alloy now is faced by a strong competitor since the corrosion resisting properties of aluminum brass were discovered. Aluminum brass in water, quickly forms an oxide film sufficiently strong and impervious to corrosive influence, to protect the underlying metal from wastage. The oxide

film also is self-healing. Should local abrasion expose the base metal, a new film contiguous with the adjacent portions of the old, quickly grows and arrests that pitting which has been such an insiduous source of wastage of pure brass tubes. Several manufacturers have placed the new tubes under various trade names on the market. They are made from an alloy composed of copper 76 per cent, zinc 22 per cent and aluminum 2 per cent. Nonferrous foundrymen producing castings subject to corrosive influence, may profit from this study.

The FOUNDRY Family Photograph Album

Upper Left

T. S. QUINN

Lebanon Steel Foundry

Lebanon, Pa.

Upper Right

W. L. HEPPNER

National Rubber Machinery Corp.,

Columbiana, O.

Lower Left

WILLIAM E. TAYLOR

Taylor & Co.,

Brooklyn, N. Y.

Lower Right

S. J. HOPPER

Newman Mfg. Co.,

Cincinnati

Men of Industry

Whose Activities Are Making Foundry History

ARNOLD LENZ, manager of the gray iron foundry, Chevrolet Motor Co., Saginaw, Mich., has become assistant manufacturing manager of Chevrolet under the merging of administration by which WILLIAM S. KNUDSEN becomes president and general manager of Chevrolet and Oakland Motor Co. Mr. Lenz will remove to Flint where he becomes the ranking plant executive of that branch of the organization.

Arnold Lenz

Mr. Lenz was born May 10, 1888, at Hauingen, Germany, and came to the United States when 14 years of age. He attended New York State Normal school for two terms. In 1908, he accepted his first position with the Browning Foundry Co., Ravenna, O. Since that time he has served in various capacities with the Alliance Brass & Bronze Co., Alliance, O., Ryder Brass Foundry Co., Bucyrus, O., American Clay Machinery Co., Bucyrus, O., and the American Range & Foundry Co., Cleveland. In May, 1916, he secured a position with the Buick Motor Co., Flint, Mich., where he rose to assistant foundry superintendent in the same year.

In January, 1919, he accepted a position as assistant to the manager of the Aluminum Casting Co., Detroit, but returned to the General Motors Corp. the following May as superintendent of the gray iron foundry of the Saginaw Products Co., Saginaw, Mich., then under construction. In 1922 he became manager of that plant and in June, 1925, he was promoted to assistant to the general manager of the Saginaw Products Co., in charge of gray iron and malleable iron foundries. In 1927, the gray iron foundry was taken over by Chevrolet and he became, as manager of that plant, a part of the Chevrolet organization. Mr. Lenz is a director of the American Foundrymen's association.

^ ^

D. ANSON MARSTON, dean of engineering, Iowa State college, Ames, Iowa, will retire from his administrative duties June 30. He will be succeeded by PROF. T. R. AGG, assistant dean of engineering.

^ ^

ARTHUR ROLDER was re-elected president of Colorado Fuel & Iron Co., Denver and Pueblo, Colo., at the recent directors' meeting, JESSE F. WELBORN, chairman of the board, and all other officers also were re-elected. Previous to the meeting, stockholders had elected all directors for the ensuing year.

^ ^

G. A. SEYLER, Lunkenheimer Co., Cincinnati, has been elected president of the Cincinnati branch of the National Metal Trades association, Chicago. H. A. FELDBUSH, of the Worthington Pump & Machinery Corp., has been named vice president; P. G. MARCH, with Cincinnati Shaper Co., treasurer; and B. B. QUILLEN, of the Cincinnati Planer Co., secretary.

^ ^

GEORGE R. CASEY, formerly sales manager, Treadwell Engineering Co., Easton, Pa., has been made vice president and general manager of that company, succeeding A. A. Neave, resigned. Mr. Casey has been identified with the steel foundry business since 1911 when he became connected with the Treadwell company as timekeeper in its steel foundry. Later he was employed as laborer, molder's helper, coremaker, cleaning boss, shipping clerk and foundry clerk in the steel department. Following the completion of his apprenticeship he followed much the same procedure in the gray iron foundry of that company. In 1916 he was transferred to the sales department, in 1924 he was appointed sales manager and in 1928 he was elected a director of the company. Mr. Casey has been active in the work of several associations identified with the foundry industry. He is vice president, Eastern division, the Steel Founder's Society of America, and was instrumental in bringing about the formation of the Steel Castings Development bureau in 1928, serving as president of that group in 1929.

George R. Casey

^ ^

C. H. CROCKER, comptroller, Worthington Pump & Machinery Corp., Harrison, N. J., has been elected vice president in charge of the comptrollers' division of the American Management association.

^ ^

NORMAN J. GOULD was re-elected president and added to the directorate of Gould Pumps Inc., Seneca Falls, N. Y., at the directors recent meeting. Other officers re-elected were: C. W. COLBY, vice president; S. S. GOULD,

vice president and secretary; H. W. Foules, vice president and sales manager, and E. William Medden, treasurer.

^ ^

George P. Torrence, vice president in charge of operations at Indianapolis for Link-Belt Co., Chicago, was elected president of the company at the fifty-eighth annual meeting of the stockholders March 22. Mr. Torrence moved to Chicago recently from Indianapolis. A graduate of Purdue university in 1908, Mr. Torrence has had 21 years' experience in various departments of the company which he now

George P. Torrence

heads. Following graduation he spent a year in Arkansas in the employ of the Ayer & Lord Tie Co. Then came a two-year apprentice course in the Pittsburgh shops of Westinghouse Air Brake Co. In 1911 he entered the Link-Belt organization as a sales engineer at Indianapolis. Four years later Mr. Torrence was placed in charge of merchandise and chain sales in the company's western division. His headquarters at that time were moved to Chicago, but in 1920 he returned to Indianapolis in the capacity of sales manager of the Ewart works. In 1925 he was made general manager of both the Ewart and Dodge plants. Three years later he was appointed vice president of the company with headquarters in Indianapolis. His next step was to the presidency, where he is now responsible for the managementof Link-Belt's 17 plants and warehouses and sales organizations in principal cities.

^ ^

Arthur B. Bentley, president of Miehle Printing Press & Mfg. Co., Chicago, has been elected a director of American Steel Foundries, Chicago. Directors have elected Thomas Drever vice president and treasurer of American Steel Foundries. He previously has been secretary and treasurer. O. E. Mount has been made secretary and assistant treasurer, and E. C. Rhymer has been elected assistant secretary.

^ ^

S. M. Brah, formerly apprentice supervisor, Tri City Manufacturers' association, Moline Ill., recently was made district manager for the International Correspondence schools in the Minneapolis and St. Paul area. Mr. Brah served his apprenticeship as a machinist at Milwaukee, attending Marquette university as a co-operative student in engineering. During his school term he was employed by the Milwaukee Bridge & Iron Works, Wisconsin Highway commission and the W. W. Oeflein Construction Co. Following graduation in 1925 he was employed by the City of Milwaukee as assistant senior engineer on design. He joined the staff of the business service department of the International Correspondence school in 1926 and was active in the installation of apprenticeship and foremanship training programs in various shops and communities. While at Moline, he was active in the work of the Quad City Foundrymen's association, serving as secretary and treasurer of that group and also chairman of the apprenticeship committee of the American Foundrymen's association.

^ ^

J. S. Watson, vice president, and general manager of the Indianapolis division of the Link-Belt Co., Chicago, has been elected a director of the Associated Employers of Indianapolis for three years to succeed George P. Torrence, recently elected president of Link-Belt Co., and transferred to Chicago. In a recent issue of The Foundry it was inferred inadvertently that Mr. Watson had been elected a director of the Link-Belt Co.

^ ^

Frank Cooke recently has taken over the Meeker Foundry Corp., Norwalk, Conn., and will occupy the positions of president and general manager. Mr. Cooke was connected with the gray iron foundry, Eastern Malleable Iron Co., Bridgeport, Conn., from October, 1929, to February, 1932; Chevrolet Motor Co., Saginaw, Mich., from April, 1929, to September, 1929; with the Santa Fe Foundry, Richmond, Calif., from 1924 to 1929.

^ ^

Gen. Otto H. Falk, president of the Allis-Chalmers Mfg. Co., has been elected a director of the Harnischfeger Corp., Milwaukee, to succeed J. O. Eaton, Cleveland. The addition of General Falk to the board fulfills the desire of the late Henry Harnischfeger and of present principals in the corporation that he become associated with the company. All other directors were re-elected at the annual meeting of stockholders, and directors re-elected all officers.

^ ^

Albert E. Grover, cost consultant, Berea, O., recently was appointed cost director, Gray Iron institute, Cleveland, serving particularly members in the central and western territories. Mr. Grover has had considerable experience in association cost work, having been cost consultant of the National Machine Tool Builders' association

Albert E. Grover

for three years previous to last October when he resumed his independent cost consulting practice. He started his cost accounting work with the Geneva Metal Wheel Co., Geneva, O., in 1904. Seven years later he was employed by the firm of Nau, Rusk and Swearingen, Cleveland, certified public accountants and during the eight years he was connected with that company he specialized in foundry work. He then became comptroller, Dunham Co., Berea, O., but in 1921 returned to the professional field, being employed as cost manager, Kohr, Brubaker & Fisher, Cleveland. A short time after that he established his own cost accounting practice and in 1928 formed the connection with the National Machine Tool Builders' association. Mr. Grover also will take over the work of the institute formerly handled by Charles E. Mitchell, resigned.

^ ^

E. H. Morrell, for the past 11 years connected with the manufacturing and distributing department of the National Radiator Corp., Johnstown, Pa., has been appointed purchasing agent of that corporation.

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Fifty thousand (50,000) tons of *properly graded* ALBANY SAND always on hand.

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Albany, N. Y.

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Reader's Comment

Interesting communications from readers of The Foundry

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Too Many Flasks

TO THE EDITORS:

Anent the artcle by Pat Dwyer on page 35 of the Feb. 15 issue of THE FOUNDRY in which the statement was made that a molder and helper produced 190 flasks of trolley wheels per day with four wheels to the flask. The most interesting part pertained to the activities of the helper who made 760 cores, placed the molds on the pouring stands, shifted the weights, shook out the castings, took the castings to the cleaning room, cut the sand and—presumably—floured the molds, set the cores and assisted in pouring off! The article brings to mind a cartoon that appeared several years ago entitled, "Nothing to do 'til tomorrow!" The question naturally arises: What does the helper do to fill in the balance of his working time?

E. R. BOEHM.
1014 *East North avenue,*
Baltimore.

EDITOR'S NOTE—Thanks to Mr. Boehm for calling attention to an error. The item should read, "The daily output for a molder and helper is 110 flasks with two wheels in a flask."

Test Explained

TO THE EDITORS:

In an article published in the Feb. 1, 1932, issue of THE FOUNDRY my colleague J. H. Vogel and I touched upon a method of testing the metal from an electric furnace before pouring the castings as follows:

Prior to pouring the heat, a fracture bar the thickness of which tapers from ¾-inch down to ⅛-inch, is poured, cooled in water and broken. This determines whether or not any correction must be made to prevent excessive hardness in the castings.

Through THE FOUNDRY, W. O. Larson, foundry manager, Hill Clutch Machine & Foundry Co., Cleveland, has asked for further detail of this test as follows:

* * * * I believe the test bar could be adapted to cupola practice and a series of standards established * * * * Will you be good enough to find out from the authors if these test bars are poured in sand or in permanent molds, the time allowed for solidification and the time interval before the bar is quenched?

The test wedges are made in sand molds, but can be made cheaper and almost as well by simply drawing the pattern out of a sand heap. As soon as the metal is set so that the thin part of the wedge will not break, the bar is removed from the sand and quenched immediately. The cooling time is about one minute. The large top end is grasped by a pair of tongs, the wedge is placed on the floor and the sand is rubbed off. The thick end is placed in the water and lowered gradually until the entire piece is submerged. Wedges treated in this manner give positive evidence of the depth of chill one may expect in any given section of casting. They cannot be used for analytical purposes on account of the hardness set up by the drastic quench which makes drilling impossible. We pour a duplicate wedge for this purpose and allow it to cool in the sand.

J. C. BENNETT,
Metallurgist.
York Ice Machine Co.,
York, Pa.

Apprentices

TO THE EDITORS:

The letter "To Train Apprentices" on page 25 of THE FOUNDRY for Feb. 15 is very interesting.

We do not know of any successful, formal foundry apprenticeship which is carried on without the school attendance requirements. The purpose of class work for the ordinary apprentice is merely to acquaint him with the fact that there is a mass of technical knowledge which is fundamental in the foundry industry and to instill in him at least a respect for this knowledge.

The ordinary apprenticeship course requires about 400 hours of actual school attendance. This is equal to approximately 65 days of full time school attendance. It is obvious that the apprentice will not learn enough in this short time to instill in him a desire to do supervisory and technical work rather than trade work.

Moreover, the actual proportion of indentured apprentices to total employes in the foundry industry today is so low that if all of them became foremen, superintendents and metallurgists, there would still be opportunity for others to enter these higher ranks.

It requires about one apprentice for every five molders and other mechanics to maintain the existing population of such men against the normal losses in their ranks incurred every year.

It is a far cry from urging the need for the training of technical men to urging such training for every one who intends to work in a foundry. The two should not be confused.

It is very gratifying to see that there is someone who takes sufficient interest in apprenticeship training to take the trouble to express his thoughts on the matter. If "One who has tried" were not interested in young men and in the foundry industry he would never have bothered to write the letter. Go for him.

C. F. FREUND,
Apprentice Supervisor.
The Falk Corp.,
Milwaukee.

Tells Founders To Search for New Uses

Arthur J. Tuscany, manager, Gray Iron institute, Cleveland, was the principal speaker at the regular monthly meeting of the Detroit Foundrymen's association held at the Fort Shelby hotel, Detroit, on March 24. In discussing "How the Foundryman Can Cash In on Hard Times," Mr. Tuscany stressed the remarkable results to be achieved through the co-operative study of casts, merchandising, and technical features of the foundry business. He stressed the value of new uses for cast products as an aid to business in times of depression and recommended a careful study of the information on the subject which has been developed by the institute.

C. E. Hoyt, executive secretary of the American Foundrymen's association, spoke briefly on the coming convention of the A. F. A. at Detroit and outlined some of the plans for that meeting. James L. Mahon, American Car & Foundry Co., Detroit, and president of the association, completed the appointment of committees which will assist in preparing plans for the reception of visitors at the annual convention in May.

Opens Consulting Service

O. D. Conover, for the past three years vice president of the Foundry Equipment Co., Cleveland, has established a consulting engineering service on the layout and design of industrial plants and foundries. Mr. Conover for ten years was affiliated with the Austin Co., Cleveland, and previous to that time was vice president, T. W. Price Engineering Co., New York and Chicago.

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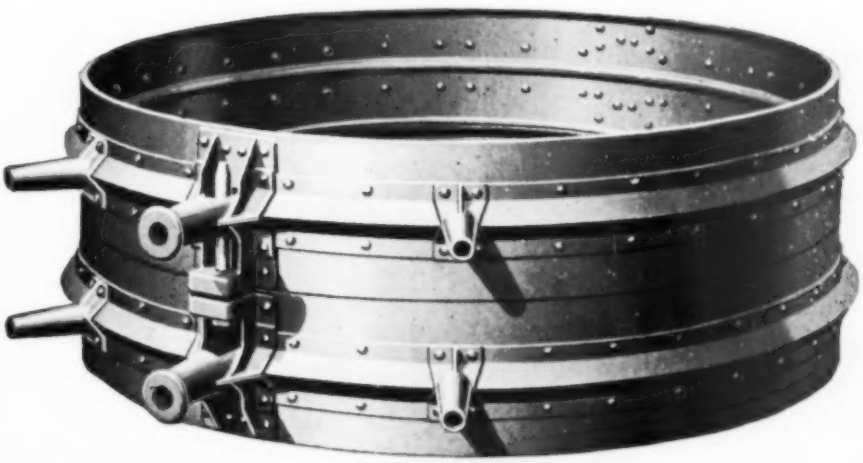

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Prevent Losses with

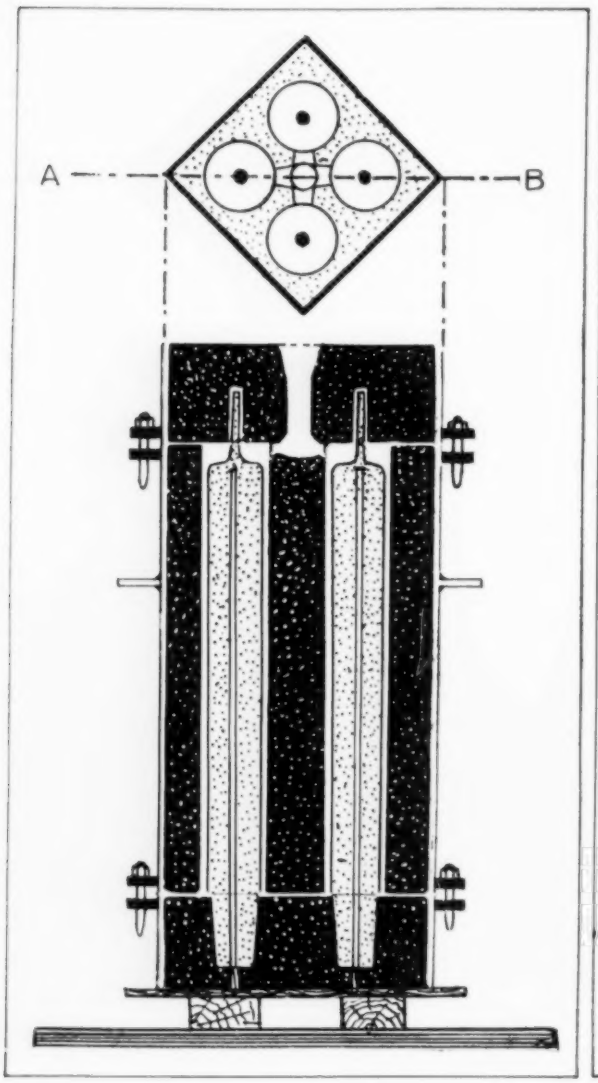
Proper Gates and Risers

By PAT DWYER

ATTENTION was directed in the March 1 issue to the danger incident to pouring cold metal. Without conscious effort to lead the investigator astray, evidence sometimes is submitted that is the truth, but unfortunately it is not the whole truth. Thus for example, the person directly in charge of pouring the metal will maintain that the pyrometer registered the exact temperature required. However, what he does not say, is that the temperature was taken before the metal was poured into the first mold. Conceivably a serious drop in temperature might be noted if a reading was taken before the metal was poured into a second or a number of molds.

In the instance under discussion, porous castings disappeared when the metal was poured hot. Hot means a bright orange for the 88-10-2 alloy and for the 85-three-fives, or ounce metal. The zinc smoke breaks readily and leaves a bright surface which does not film over too rapidly. Some molders are afraid to pour bright, liquid brass on the plea that it will destroy the mold. If it does, the molds have not been prepared properly, or, the sand is not adapted to the purpose. Attention of these molders is directed to the fact that suitable green sand molds are filled with liquid steel, a metal infinitely hotter than any nonferrous alloy with the possible ex-

(*Continued on Page* 60)



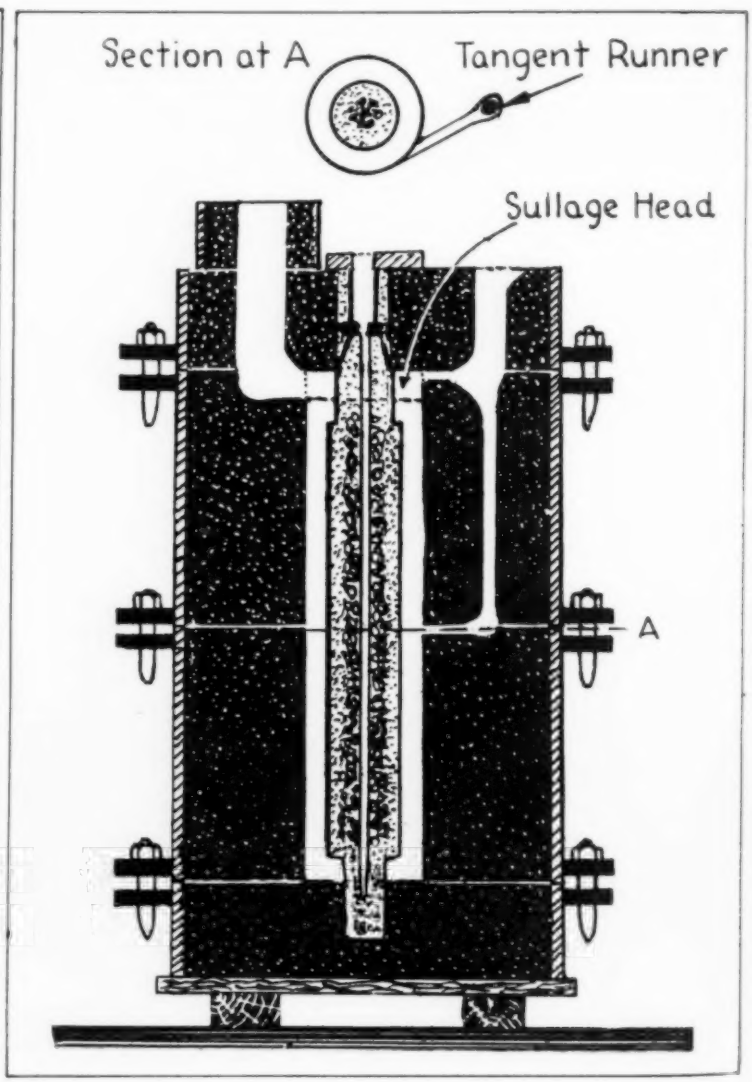
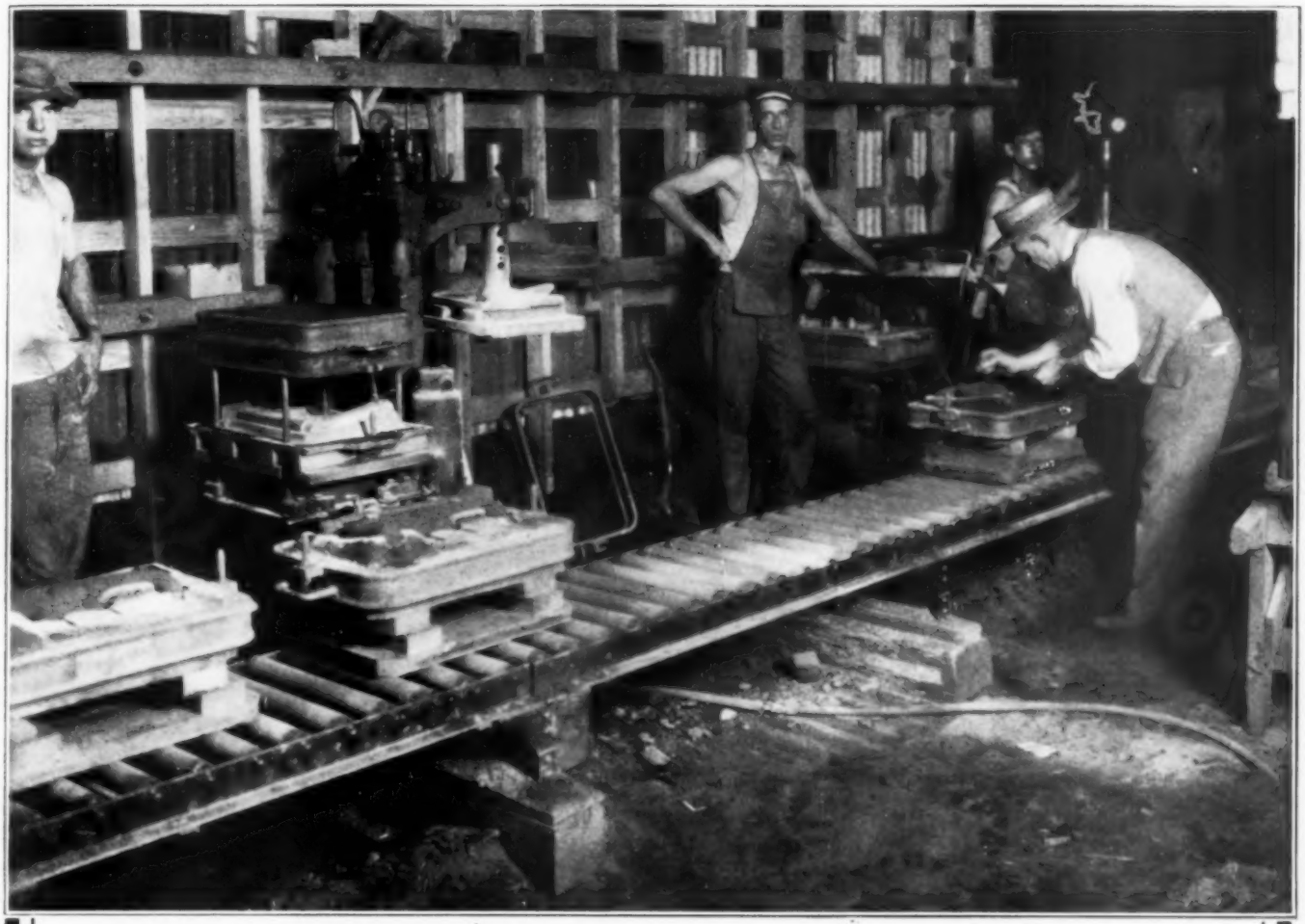


Fig. 154—(Left)—Four upright bushings in a single flask are gated at the top. Fig. 155—(Right)—This casting is poured through a gate half way down and another at the top. A sullage head catches the dirt and serves as a feeder



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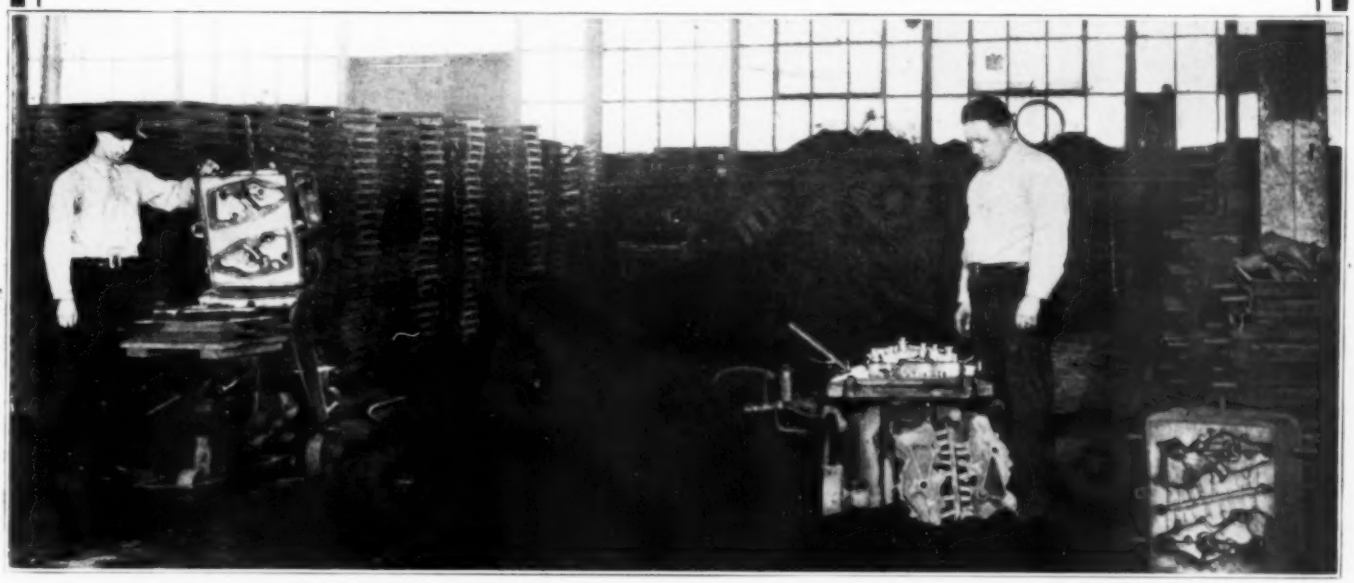

Cores Cause Trouble

MOLDS for some cylindrical bronze castings are made in green sand with dry sand cores to fill the central spaces. Patterns for others leave their own cores, that is the pattern serves to form both the mold and the core and leaves them both in their proper relative positions. Whether a green sand core is the cheaper depends on a number of factors. Usually it is not applicable where the casting is poured in a horizontal position. A green sand core introduces several hazards into many bushing or ring molds that are poured while in a vertical position. Local conditions, the size and shape of the casting, the character of the sand, and in some instances the temperature and analysis of the metal, must be taken into consideration. In some instances a wide choice may be enjoyed in the selection of a gate. In others the choice is limited to one or two types.

(*Continued from Page* 58)

ception of some of the nickel alloys.

Also the melter and molder must bear in mind that all alloys are not *hot* at the same temperature. Yellow brass and other alloys containing a large percentage of low melting temperature metals would be considered *hot* at 1800 degrees Fahr., the solidification point of the 88-10-2 alloy or the ounce metal. However, ounce metal looks hotter than the 88-10-2 alloy at the same temperature, and inexperienced men pour it too cool to secure solid castings. This feature should be watched.

According to the research effort of many authorities, the best pouring temperature for 88-10-2 alloy is 2192, approximately 2200 degrees Fahr. A pouring temperature of 2100 degrees Fahr. may be considered the minimum and only is applicable for castings of massive section. Other experiments showed that unsound castings resulted when the metal was poured at 2552 degrees Fahr. Obviously this finding does not apply to extremely thin castings which must be poured at a maximum temperature.

Pour Metal Hot

The alloy known as ounce metal —copper 85 per cent, and 5 per cent each tin, lead and zinc—frequently is employed for heavy castings. In some instances the large castings display defective areas, while small castings from the same heat are solid and clean. Raising the temperature of the metal on the next occasion will cure the trouble. If necessary the mold can be coated with plumbago and dried, or, skin dried.

Precautions for securing clean gray iron castings described in former installments of this series apply with equal force where brass and bronze castings are concerned. Thus a pouring basin is provided on top of the cope, where the metal can accumulate until the basin is filled. A plug then is withdrawn from the sprue opening and the molder is assured that fresh, clean metal enters the mold. Various types of pouring basins and the method of application have been covered.

Usually, green sand basins serve admirably, but in some instances the sand itself is not sufficiently refractory and in others green sand will not resist particularly severe erosion. In instances of that kind the basin is formed from a core sand

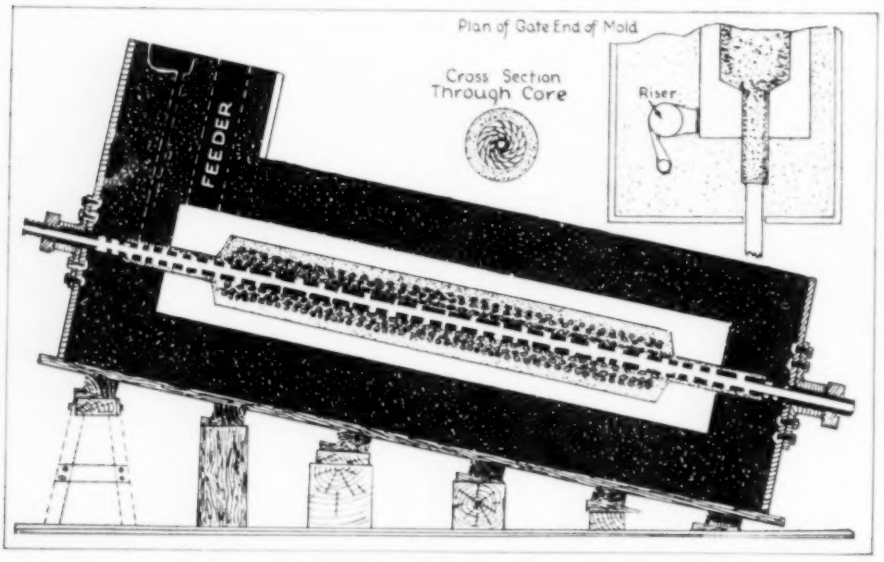

Fig. 156—Combination gate and riser is located near the elevated end of the mold

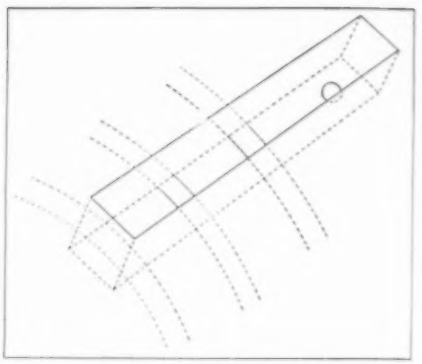

Fig. 157—Metal enters the bottom of the mold

mixture and is dried before it is placed in use.

The conical cast iron plug on the end of the rod usually is covered with blacking that has to be dried, or, with a mixture of oil and blacking that theoretically may be employed in the natural condition. However, the plug—particularly if unused for some time—seems to possess an extraordinary attraction for dampness. The smallest amount of moistures will cause the molten metal to boil violently in the vicinity, and incidentally release all the blacking. Any noticeable amount of moisture will create sufficient steam to blow all the metal out of the basin. Prudence suggests that all plugs should be dried before they are used.

The term bushing includes a wide range of castings, sleeves, liners, rings, cloth printing rolls, plungers for various purposes and in fact practically all hollow cylindrical castings. Small pump plungers shown in Fig. 154 are typical of that class of castings and have been selected to illustrate the method employed in molding and gating them.

Four patterns are employed and are molded vertically in a three-part flask with the cores resting in large prints in the drag. The small print at the upper end would introduce an extra hazard if the core was laid horizontally in the mold. The most important feature in this layout is the sand. It must be of a free venting variety and must be worked with a minimum of moisture. Men skilled in making vertical molds of this kind employ a sand so dry that it would not stay in a flask handled horizontally. The metal enters the four molds simultaneously from small gates in the top joint connected to the central sprue.

Vent Through Bottom

Vent from the cores is taken through an opening in the bottom core print. A vent wire is pushed down through the print and wiggled around until it comes into contact with a long lifter or a hack saw

(*Continued on Page* 62)

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(*Continued from Page* 60)

blade, pushed in horizontally between the lower edge of the drag and the bottom board.

Under favorable circumstances, no need exists for lifting the cheek. Tapered, tight fitting prints on the lower ends of the cores insure a tight fit and will prevent any metal from leaking down and into the vent. In a few favored sections, the sand for these cores requires no artificial venting, but in the majority of instances the cores must be vented, and vented liberally, to insure clean solid castings.

Sand in the mold must be rammed hard to prevent the castings from swelling. Consequently the sand must be dryer than usual. Sand of ordinary molding dampness will generate sufficient steam to spoil the castings. In extreme instances the steam will cause the mold to vomit its contents through the sprue.

Many foundrymen prefer to mold long plungers horizontally and cast them on an incline. In some instances the castings are gated at the low end and in other instances they are gated at the high end. One advantage of this method is that the mold is not strained as severely as

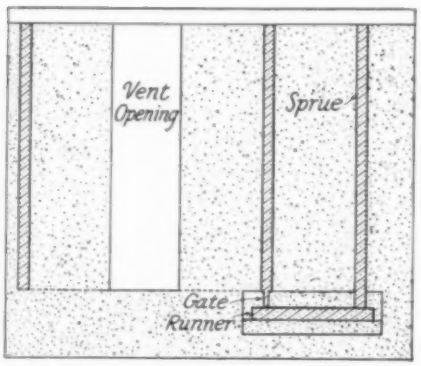

Fig. 158—Diagrammatic view of the application of a runner core to two ring castings in one mold

where the casting is poured vertically. However, the majority opinion favors the vertical mold with rigid flask and dry, open sand rammed to a density that will resist the pressure of the metal. A gate at or near the bottom is cut at a tangent to impart a whirling motion to the metal and thus assist in keeping any foreign material floating on top where it eventually may enter a sullage head on top of the casting. On long plungers it is customary to cut auxiliary gates at the top and at one or more points between the top and the bottom. These gates serve to introduce fresh, hot metal which revives the metal which has risen from the bottom.

Poured On Incline

Method adopted successfully by at least one foundryman in the production of cloth printing rolls is shown in Fig. 156. The casting is quite large from a brass foundry standpoint, 6 feet in length and 14 inches in diameter. The flask in which the mold is made is 7 feet 6 inches in length and each half is 15 inches deep. The flask is 24 inches in width to accommodate a gate at one side near the top as shown in the illustration. A much narrower flask —18 inches at a pinch—might be employed if the mold was gated at or on the high end.

On account of the narrow neck at each end of the core, free escape of the gas is retarded to a certain extent. Therefore extra precaution must be taken in the construction of the core to insure a free exit for the gas. If the gas is retarded to the extent of setting up even a slight agitation in the metal, the ef-

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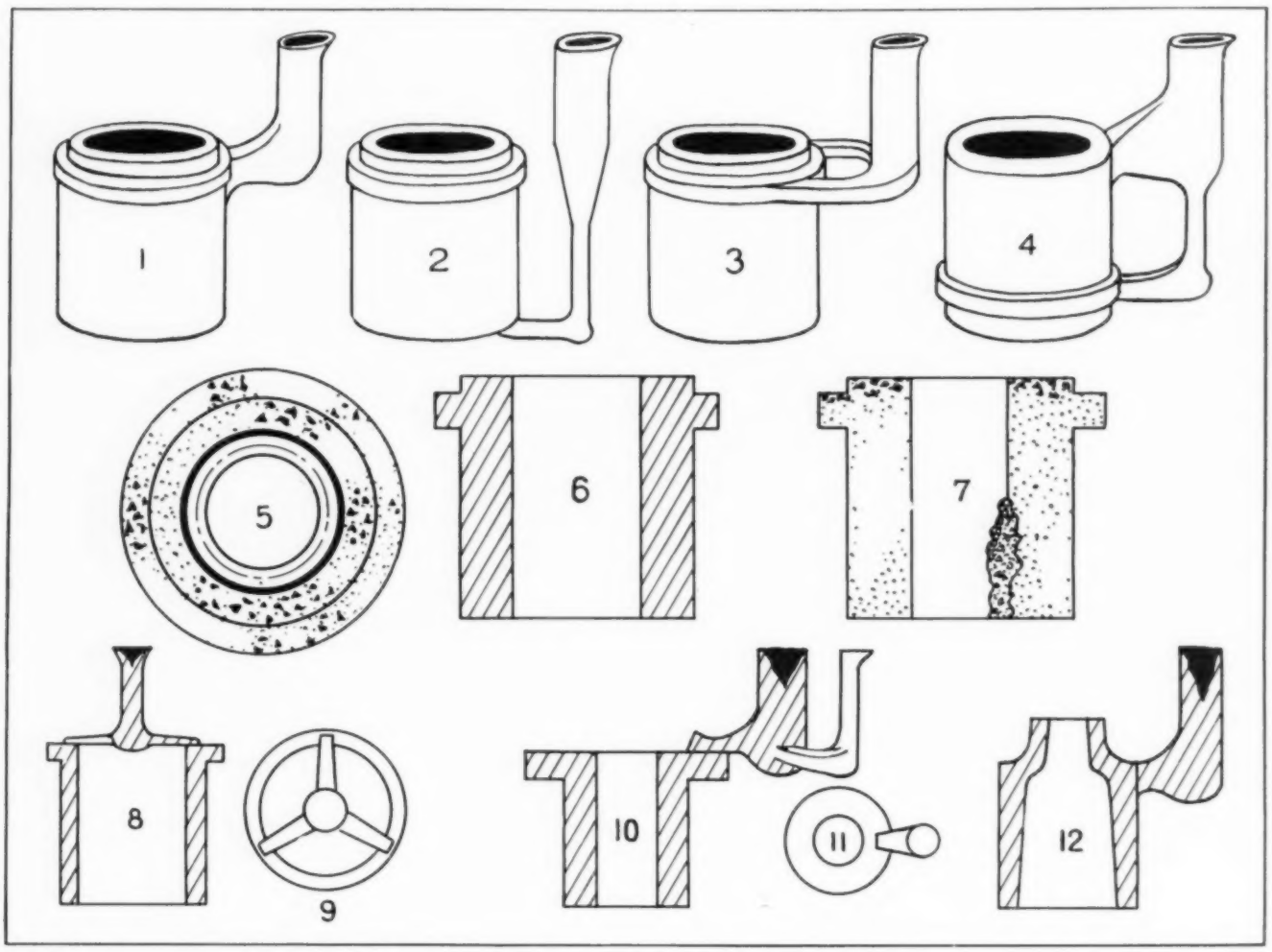

Fig. 159—Illustrating application of various types of gates to bushing castings. No. 7 shows the result of a gate through which the metal cuts away part of the core and scatters the sand through the casting

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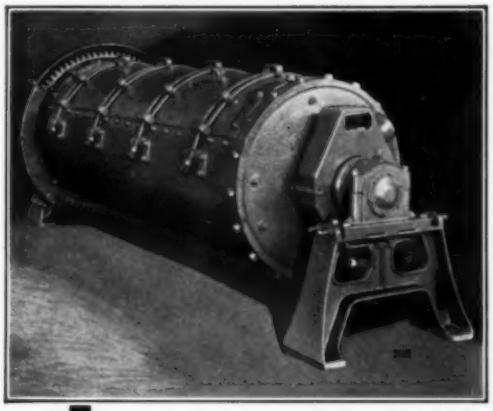

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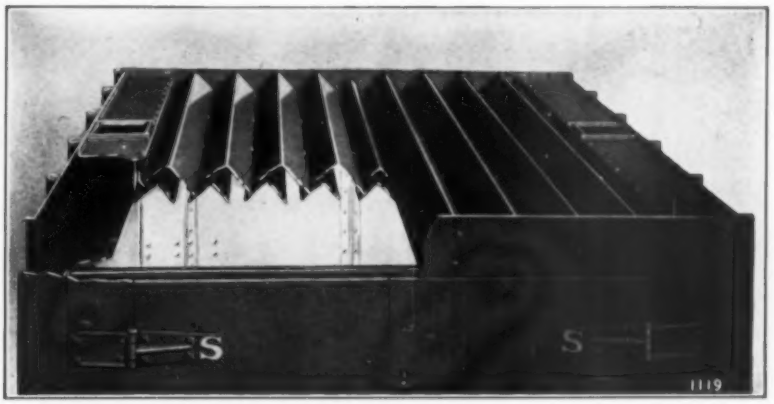

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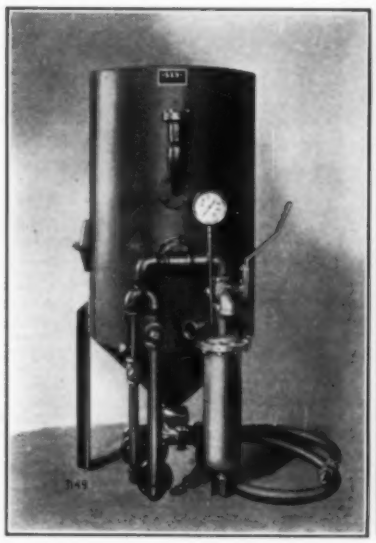

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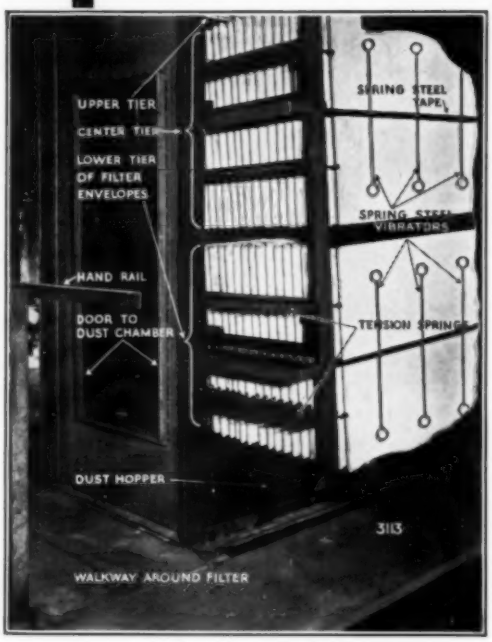

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(*Concluded from Page* 62)

fect will be manifested in porous areas in the casting, usually invisible until after the first cut has been taken from the surface. The core also must be strong and rigid to prevent it from springing in the center under the heat and pressure of the metal. The face of the casting is machined and then engraved, therefore a chaplet or chaplets cannot be employed on the core.

In Fig. 156 the core is shown swept on a steel pipe 2 inches outside diameter, ⅜-inch thickness of metal and drilled all over with ¼-inch holes to admit the gas from the core. The ends of the arbor are threaded and extend through openings in the ends of the flask. With the core in place in the mold, a nut is placed on each end of the arbor and tightened up against the end of the flask. Thus the core is held securely until the mold is filled with metal. The heat from the metal causes the arbor to expand, which it does freely through the ends of the flask. The nuts are slacked off or removed from the ends of the arbor before the casting begins to contract.

Board Should Be Braced

A drag with bars or reinforced with an iron bottom plate should be used on a job of this kind. Unfortunately a brass foundryman sometimes has no alternative but to use a wood bottom board. This board should be braced strongly at short distances apart as shown in the illustration. The mold is raised about 2 feet at the pouring end and additional pressure is placed on the metal by a pouring basin which also contains a continuation of the riser or feeder. Approximately 3000 pounds of metal are required to pour this casting. Manifestly from the size and shape of the casting, the amount of metal and the height of the pouring head, the flask must be clamped securely. Where it is possible to partly bury a flask of this kind in the floor, the shop crew experiences more of a feeling of safety.

Brass and bronze castings under the generic title *rings*, range in size from that of a thimble to several feet in diameter. Metal thickness and height show the same wide variation. For the moment consideration will be confined to rings approximately 12 inches in diameter and about the same height.

Following the line of least resistance and with no thought to the condition of the casting, the careless molder will cut two or three branch gates to connect the top of the casting with the sprue. If the flask is too small, he will place the sprue in the center of the circle and then cut a number of radiating gates on top of the green sand core. Strange as it may seem and this is particularly true with hot fluid metal, some of the castings gated in this manner turn out satisfactorily.

However, the percentage of wasters is high. A recommended method for gating the larger rings is shown in Fig. 158 where the metal enters the bottom of the mold through a dry sand core made in two sections. This core relieves the molder of the necessity of lifting the cheek or the core after removal of the pattern. In some instances it may be advisable or necessary to take the mold apart for an application of blacking—wet or dry—to the walls. The style of gate shown in the illustration is applicable under any and all conditions. That style of gate core may be applied readily irrespective of whether the pattern for the ring is rolled over or bedded in the drag. That type of gate also is particularly applicable where two or more rings are molded one inside the other in a single flask. Instead of a single gate opening, the gate core is provided with an opening for each of the rings.

A slightly alternative method, one that was touched upon in No. 18 of this series published in the Oct. 1, 1931 issue of THE FOUNDRY is shown in Fig. 157. In that method a long rectangular runner stick or block is laid horizontally on the ring patterns when the sand has been rammed to the top in the inverted drag. Additional sand then is rammed around the runner stick and slicked off flush with the upper surface. The stick then is removed and the runner opening or trough is covered with a flat core and the remaining space in the drag is rammed full of sand in the usual manner. A vertical sprue close to the outer end conducts the metal to the runner which introduces it to the bottom of the three rings. On large rings, or where the metal has to travel a considerable distance, two runners should be provided at opposite corners of the flask and the metal should be poured into the mold simultaneously from two ladles or crucibles.

Metal Is Cold Shut

As molten metal rises in a mold it loses temperature and fluidity. The metal immediately in contact with the sand develops a slight skin or film. The van of the stream, unless extremely hot and fluid, develops a similar film. Where the stream enters the mold through a single gate at the bottom and then separates into two streams that travel around the ring to meet at a diametrically opposite point, this film may be sufficient to prevent an intimate union of the metal from the two streams. The result will be a cracked casting. For that reason, metal should be poured rapidly and from two or more crucibles in instances where the drop in temperature is more rapid than usual between the gate and the riser.

Many features connected with the gating of bushings are shown in Fig. 159, a group of bushings in which the pattern is designed to leave its own green sand core. A dry sand core involves the service of a coremaker, the cost of sand, binder and fuel. Therefore where the circumstances seem to warrant, a green sand core is employed. However, in all cases it is well to bear in mind that casting losses are higher with green sand cores on account of scabs, cuts, blows that appear on slight provocation.

Green sand may give little trouble with thin castings, but unless the sand is particularly suitable it will cause trouble if used for green sand cores in heavy castings. For example a fine sand surely will scab if used for a core in a bushing of the type shown at 1, 2, 3 and 4 in Fig. 159. The metal entering at the bottom will gouge a cavity in the face of the core and if the casting eventually is split, it will show a section as in 7 and the cope face will be filled with sand holes as shown at 5 in the same illustration.

With a good open grade of sand no trouble will be experienced with green sand cores in these bushings. It is assumed that the sand is held to the proper moisture content and that it is rammed to the proper density. The best way to ram the sand in the smaller patterns is to throw it in by hand. This requires a nice degree of skill and judgment only gained through experience.

This is the twenty-ninth of a series of articles dealing with the various types of gates and risers used in the foundry industry. The thirtieth installment will appear in an early issue.—THE EDITORS.

Chicago Foundry Melts Guns for Scouts

Melting of gangsters' guns into a plaque for boy scouts was the occasion of a ceremony recently at a cupola of the Chicago Foundry Co., 2028 North Major avenue, Chicago, which was attended by Mason Phelps, president of the executive board of the Boy Scouts of America, and 20 members of troop 12 of the Boy Scouts organization.

Judge Edward B. Casey, of the Chicago municipal court, placed the 50 assorted weapons taken from criminals into the cupola with the words, "There is no such thing as a good gun; all guns are bad, and intended only to take life." The weapons formed a part of the metal that was molded into a plaque 2 feet long and 1 foot wide, bearing the inscription of the Boy Scout oath.

Fig. 1—A 22-foot all metal inboard runabout built by Birmal Boats, Southampton, England

Castings Displace Wood In Motor Boats

ADVANTAGES of metal as boat material have been realized for many years, but up to the present have not been exploited to any great extent. A prominent boat builder in the Middle West stamps sheets for the hull, but the usual practice is to use wood for the keel and knees even with a metal hull. Recently a British company, the Birmingham Aluminium Casting Co. Ltd., organized a subsidiary company known as Birmal Boats to manufacture all metal boats from a special corrosion resisting aluminum alloy possessing great strength. As a result of experiments extending over the past two years the company has standardized two models, a 16-foot outboard hydroplane, intended for the larger outboard engines, and a 22-foot V-bottom inboard runabout.

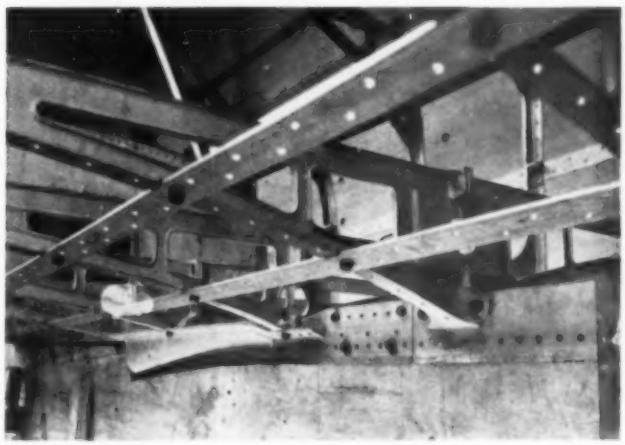

Fig. 3—Closeup of the all metal hull showing the cast stern tube and the method of fastening frames to the keel

As pointed out by *Power Boating*, the outstanding feature of the 16-foot hull is that the entire shell, including the bottom, sides, deck and transom is made up of castings. The shell itself is cast in two pieces, riveted or welded along the center line. The transom is a separate casting strengthened by horizontal and vertical webs and riveted to a flange cast in the after end of the two halves of the shell. The deck is constructed from castings. The hull is strengthened by a number of webs cast integral in the bottom and sides and is stiffened by water tight bulkheads.

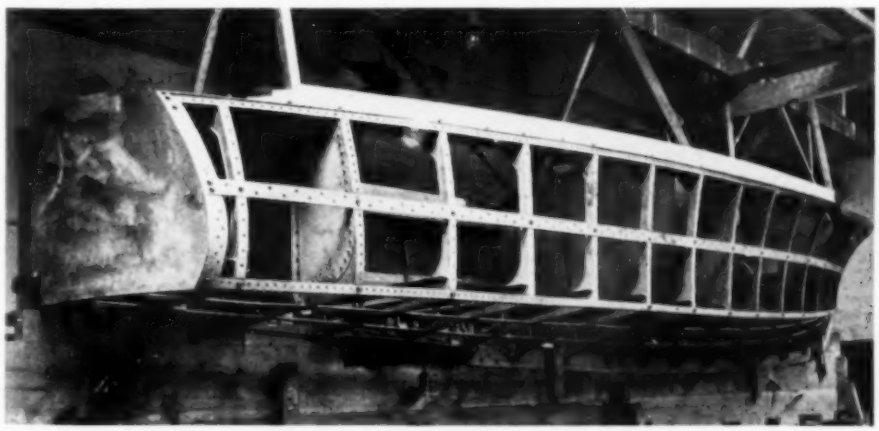

Fig. 2—View of the framing illustrating the use of aluminum castings

Employ New Framing System

An entirely new framing system is employed on the 22-foot model. The entire frame is composed of light castings. The shell and deck are plated with high tensile aluminum alloy sheets riveted to the frame. Angle section gunwale bars, chines and stringers impart exceptional longitudinal strength and stiffness to the hull. The stringers, flat metal ribbands, are let in flush with the surface of the transverse frames. The weight of the hull is approximately 1000 pounds, claimed to be about 40 per cent lighter than a

(*Concluded on Page* 67)

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(*Concluded from Page* 65)

wooden boat the same dimensions.

The constructional framing of the hull presents several special features, a breast hook cast integral with the stem head, transverse frames to the keel, a sleeve piece or stern tube boss cast in one piece with the stern frame and provided with a special bracket connection to the transom and flanges to take the bottom plate rivets. Each frame is made up of two castings which carry the beam knees, seat lugs, floor plates, reverse bars, engine girders, etc. Special provision also is made on the frame for stern tube connection, water tight bulkhead glands and other fittings.

In addition to lightness and great strength it is claimed that the aluminum alloy used in the construction of these boats is immune to salt water corrosion. It is not the usual silicon alloy usually considered best for corrosion resistance. The boat metal alloy contains a certain amount of magnesium and only a trace of silicon. The company's experience with aluminum alloys of all kinds probably is unsurpassed and the present metal represents a great deal of research. The company claims that the metal is proof against corrosion either in sea water or any kind of atmospheric condition.

Construction recently of a 55-foot cruiser DIANA II at the Southampton yards of the company, indicates that the material and type of construction is not confined to small boats. The hull is of semitunnel stern type fitted with deep fins port and starboard of the propellers to facilitate beaching in tidal waters. It is interesting to note that the boat is powered with a pair of American engines built by the Kermath Mfg. Co., Detroit. Each engine is capable of developing 225 horsepower at 2200 revolutions per minute.

A fairly large field for the introduction of this type of boat would appear to be the mercantile marine where the lifeboats could replace the heavy, clinker built wood boats at present in use. The special framing system lends itself readily to the production of the boats in knock down form for shipping at reduced rate and erection at destination.

Separately Cast Test Bars Discussed by British Institute

TWENTY-FOURTH annual meeting of the British Institute of Metals was held in London, March 9 and 10 in the lecture room of the Institution of Mechanical Engineers. Sir Henry Fowler, London, Midland and Scottish Railway Co., was elected president and W. R. Barclay, Henry Wiggin & Co. Ltd., Birmingham, and Dr. A. G. C. Gwyer, British Aluminium Co. Ltd., Warrington, were elected vice presidents. Other vice presidents on the board are Prof. D. Hanson, Dr. R. S. Hutton, Dr. H. Moore, and Vice Admiral Sir R. Skelton. Dr. R. Seligman, London, immediate past-president, was unanimously elected as a fellow of the institute.

Points to Advance

Sir Henry Fowler then read his presidential address, entitled "The Importance of Research Work to the Engineer." He said: " . . . we have advanced very much in the past few years toward a better understanding between the scientific and the so-called practical man. There is no doubt that the increased facilities for metallurgical education, as well as the growing importance of metallurgy generally, have helped to bring this about. Societies like our own have contributed largely to the progress made in that direction."

An interesting innovation of the meeting was the presentation of an address on "The Testing of Castings," by Dr. W. Rosenhain. The paper dealt particularly with what is termed specification testing and control testing. In view of the fact that the properties of castings frequently vary from place to place in the same piece, he favors the adoption of a separately cast test-piece, the use of small samples cut from actual castings being reserved for investigatory purposes. He recommended that endeavors be made to arrive at a standardized sand-cast test-bar for the light alloys from aluminum. He also suggested that the practice followed in cast-iron testing of using bending tests, in which deflection is measured as a means of testing ductility, be adopted. In conclusion, the author discussed the value of tensile testing, and the desirability of improving methods of testing in the interests both of the user and the manufacturer.

An interesting discussion followed Dr. Rosenhain's address. While opinion was divided on a separately cast test-piece or a test-piece cut from the casting, the consensus of opinion seemed to favor the separately cast test-piece. J. B. Hoblyn, Luton, opened the discussion by stressing the importance of the time effect in testing castings. He showed slides of castings presenting serious defects, and stated that no tests conducted on test-pieces could disclose these defects.

Dr. Sachs, Berlin, Germany, while acknowledging that separately cast test-pieces do not give complete information on the properties of the casting, said that they are the cheapest and the simplest. He stated that cast on test-pieces give closer results of the actual properties of the casting. A. H. Mundey, London, said that it is necessary that investigation tests should be carried out previously on test-pieces taken from different parts of the casting to ascertain whether the material is suitable for all parts. Then, for acceptance tests, tests made on separately cast pieces to control the material should be sufficient.

Favor Machined Test Bars

R. H. H. Stanger, London, pointed out that cast-iron test-pieces generally are not machined, and suggested that it would be advisable to use machined test-pieces as well as those used in the rough. A. J. Murphy, National Physical laboratory, Teddington, said that it often happens that the cast-on test bar gives inferior results to those obtained with separately cast pieces. He emphasized the fact that cast-on pieces can cause extra stresses in the casting itself.

R. B. Deeley, London, advocated the use of sand-cast test-pieces for light alloy castings, saying that the chilling modifies the metal in such a way that the results obtained on a chilled test-piece might be high, while the casting itself might be unsound. Dr. D. H. Ingall, Constantine Technical college, Middlesbrough, emphasized the importance of the question of unsoundness in castings such as cavities, nonmetallic inclusions, etc. He referred to the dye penetration test, which consists in painting one face of the casting with dyed petrol, and if the casting is porous, the dye penetrates to the other side.

G. Mortimer, British Aluminium Co. Ltd., stated that the first thing is to see that the right quality of metal goes into the casting, and for that reason his firm makes wide use of separately cast test-pieces. He pointed out, however, that often some little defect may remain uncovered in the casting until the last stage of machining has been reached. He suggested that complete sandblasting of the casting often can show certain defects. R. Genders, Woolwich arsenal, questioned whether the introduction of the bend test, as compared with the elongation test, adds much to the information obtained. He said that tests should be conducted in accordance with the design of the casting. He recommended that X-ray and density tests should be used as preliminary tests.

In closing the discussion, Sir Henry Fowler, president, advocated the method of breaking up the casting and locating the defects, this being followed by casting test-pieces on to the casting at those points where the defects were seen, and then breaking up the casting again. In his reply, Dr. Rosenhain emphasized the fact that there is a considerable difference between foundry technique and inspection on the one hand and testing on the other.

Work of Faraday Portrayed by Sir Robert Hadfield

Plaque modeled by F. J. Halnon, R.B.S., and cast in steel. Faraday's blast furnace is shown at the left and his famous box of 79 specimens on the table at the right

FARADAY and His Metallurgical Researches, by Sir Robert A. Hadfield; cloth, 329 pages, 6 x 9½ inches; 68 plates, 12 illustrations and 27 tables; published by Chapman & Hall, London, distributed in America by The Penton Publishing Co., Cleveland; price $6.50 postpaid.

From 1819 to 1824, before he had discovered the action of electromagnetic induction, Michael Faraday devoted much of his time to metallurgical research. Utilizing the primitive laboratory facilities of the Royal Institution at London and with the assistance of friendly steelmakers in Sheffield, he experimented with steel alloyed with nickel, silver, platinum, rhodium, iridium and osmium, palladium, titanium, copper, tin and gold. Until recently comparatively little was known of this phase of Faraday's work. Fortunately, however, a box containing 79 specimens of his steel was discovered and turned over to Sir Robert Hadfield, who has examined them by the methods of modern scientific research. Using only a pound and a quarter of the precious material, Sir Robert made 493 chemcial analyses and conducted chemical, physical and mechanical tests to the number of 866.

Pioneer of Alloy Steels

Out of the results of this unusual examination of century-old steels, Sir Robert has developed material for a book of absorbing interest. Entitled, "Faraday and His Metallurgical Researches," it not only throws light on an obscure part of Faraday's eventful life but also establishes the "Father of Electricity" as the rightful holder of the additional honor, "Pioneer of Alloy Steels."

In view of the author's own notable achievements in the discovery of alloy steels, it is easy to understand the enthusiasm with which he has delved into hidden nooks and crannies to unearth evidence of Faraday's researches. He traces Faraday's rise to fame, leaving no stone unturned in seeking out early acquaintances and associations that may have influenced the direction of the scientist's search.

The historical features of this work made under the conditions which governed over a century ago constitute a remarkable tribute to the scientific ability and the farseeing value of Faraday's work in practical research. His accomplishments under primitive conditions will interest modern steel foundrymen and metallurgists. Reference in this work to cast steel means steel which is cast into ingots. However, this record which is the earliest systematic investigation of alloy steels is of important historic value to the steel foundryman.

The author reviews the earliest beginnings of metallurgy and traces its development up to the nineteenth century. After describing in great detail his examination of the historic specimens, Sir Robert then presents numerous appreciations of Faraday's work, concluding with his own judicial appraisal, which needless to say, gives great credit to the subject of the book.

In conclusion, the author deals with more recent developments in alloy steels. The book is intensely interesting from beginning to end. It is rich in historic incidents of significance in the world of science. It is illustrated profusely and contains many tables of data relating to the author's tests of the Faraday steels.

While Sir Robert set out primarily to establish Faraday as the first to engage in systematic research concerning the preparation of alloys of steel, his book goes far beyond that objective. It affords the reader a rich background for a better appreciation of the importance of genuine and successful research—the search for and discovery of fresh knowledge. The proceeds of the sale of Sir Robert's book will be devoted to the funds of the Royal Institution to be used for furtherance of metallurgical science.

Gardens Are Cited

A report of the President's organization on unemployment relief cites the Dayton Malleable Iron Co., Dayton, O., as a firm which has co-operated in enabling its employes to conduct gardening. The company has placed about 20 acres at the disposal of its employes since 1917. In 1931, 225 gardens were planted.

The company plows and prepares the land and lays it off into gardens 40 by 80 feet. The size has been reduced to these dimensions to make as many plots available as possible, since there is not enough land to supply all requests. The men take turns as watchmen. The gardeners supply their own seeds, fertilizers, and the necessary spray materials.

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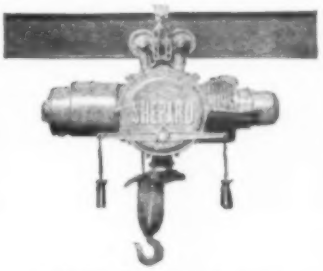

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Foundry Sales Technique

Needs same co-operative effort given to uniform cost systems

By W. J. O'MALLEY

UNWISE merchandising methods, especially the pernicious practice of freely quoting prices, possibly is the most demoralizing evil in the foundry industry today. Why so many foundrymen feel obliged to reduce prices on the slightest pretense is rather difficult to understand.

Several recent reports cover an extended sales trip of a certain foundryman, who visited a great many casting customers. He readily quoted prices ridiculously lower than those prevailing in any district. His prices were based on snap judgment.

Naturally he aroused considerable excitement and speculation but so far as we know he booked no orders. However, many buyers have used his low quotations to force a price reduction on their regular source of casting supply.

The foregoing is an example of a problem to which foundrymen must give serious and constructive thought. Loss to the foundry industry by loose sales methods amounts to a staggering sum.

Wrecking Price Standards

Exception is taken not to the actual figures quoted, but to the circumstances under which they are given; also to some of the methods now employed in selling castings. Where one occasion justifies submission of a quotation, hundreds of occasions arise where it is not necessary.

A foundryman may sell his castings at a suicide price, if he desires, and he may continue until he is broke; but he should have some positive assurance that the business will be placed with him before releasing his demoralizing quotations. The particularly aggravating feature is that the ruthless bidder seldom gets the order. He only succeeds in wrecking price standards of other foundries.

Foundry associations should institute an educational program on sales technique in the same way they educate foundrymen on how to find their costs. How to figure costs, and how to merchandise castings are items of equal importance, whether to the individual foundry or to the foundry industry as a whole.

Obviously, the object of submitting a price to a prospect is to obtain orders that will yield a profit. Price is only one of several factors to be considered in a potential transaction between foundry and prospect. Only too often the other factors, quality of castings, foundry facilities, capacity, time of delivery, credit terms, buyers' personal objections, etc. are considered more important.

Bidder Does Not Qualify

Usually the price is quoted before all the other factors are considered. The result is that the bidder does not qualify for the business in any respect outside of price, and finally does not profit in any way, by having submitted only a price. Incidents of this kind occur every day. Foundries continually are forced to lower price levels for no good reason; but simply because foolish foundrymen broadcast low prices without securing any additional business.

Buyers who prefer to purchase castings from local sources may be divided into two groups. In the first, the buyer is satisfied to continue the existing price basis. He has full confidence in the foundry; feels that he is getting good value, and is not aggressive in soliciting prices from surrounding foundries. Competitive foundries soliciting this buyer should tread lightly. He is of the gold bond type, reliable and conservative, the most desirable buyer for a foundry.

From one to a dozen gallivanting foundrymen call and visit him every week, to tender ridiculous prices on some of his work. In 99 cases out of 100 they gain nothing by this unethical price gesture. On the contrary they inflict direct injury on all foundrymen in the district. Even where the buyer is conservative the unwise price gesture often tends to weaken his confidence in his regular foundry. It encourages the buyer to at least open a price discussion. Eventually the regular foundry will be forced to reduce its prices.

The second group of buyers are determined to buy from a local source; are satisfied with the quality and deliveries; but they are keen on soliciting outside casting prices and then using any low price thus obtained to whip the local foundry in line. A visting foundryman should be on his guard. He gains nothing by submitting prices to such a buyer.

One of these men assured me recently that he would buy his castings out of town if he could get them any cheaper.

I was reluctant to quote a price without definite assurance that he would buy our castings if the price was acceptable. During the discussion I gathered the impression that if I did submit a price lower than he was paying, he would prevail upon his local foundry to meet it. Finally upon his insistence I submitted prices on eight different castings. All these prices were inflated from ¾ to 1 cent a pound above what I originally intended to quote. Comparing the prices with what he was paying locally he remarked: "There you are! We now are buying our castings at prices much lower than yours. Had you been low in price I naturally would have offered your price to our local foundry, first. They have been meeting every low price I submit to them!"

Meet the Shopper

Another type of buyer often encountered is the out and out shopper, ready to buy castings whenever and wherever he finds the lowest price. This buyer by unfair methods is able to get some of the most ridiculous quotations possible for foundries to put out.

For his own protection and the protection of others the foundryman first should get some definite assurance that the low bidder is to get the business. Then if the low bidding foundryman wishes to sell his castings at a loss that should be his own funeral. In justice to other foundries he should insist upon getting the order and upon being the unfortunate victim of his own folly. Foundrymen who quote unwarranted

(*Concluded on Page 72*)

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"The Best We've Seen in Twenty Years"

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The iron produced was soft enough for either light or heavy castings. The customer said it was the best he had seen in twenty years.

E. M. BRIQUETS for cupola addition make high quality iron because they insure complete recovery and thorough solution of the contained alloy. This method of making alloy additions is accurate, economical, and convenient. To charge a given weight of chromium, manganese, or silicon, all you need to do is to count out the correct number of briquets and add them. Time is saved. Off-iron is eliminated. Better castings are produced at lower cost.

Electromet Metallurgical Engineers will be glad to explain how E. M. BRIQUETS can be used to advantage in your foundry. Write today for further information.

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A REFRACTORY binder protects the alloy content of E. M. BRIQUETS from premature oxidation. At the hottest zone of the cupola, the binder disintegrates and releases the full charge of the uncontaminated element to the iron. Recovery is higher. Thorough solution is assured. Guesswork and waste are eliminated.

Electromet Ferro-Alloys now available in briquet form include

E. M. SILICON BRIQUETS (round)

E. M. CHROMIUM BRIQUETS (hexagonal)

E. M. MANGANESE BRIQUETS (square)

(*Concluded from Page 70*)

low prices under pressure from a price-shark buyer, simply are grave diggers.

Investigate All Points

The moral to be drawn would seem to be that it takes more than a *price* to *move* patterns. Foundrymen should follow scientific methods of merchandising their castings. They should be on the alert instead of contributing to the corruption and demoralization of the industry by blindly and selfishly following a sales technique that will not result in increased tonnage at a profit for themselves.

In pursuing a potential sale, the bidder must investigate all the circumstances involved and be sure that he has the buyers' unqualified endorsement. He also must determine whether he has any new advantages to offer the buyer and whether his plant is prepared adequately to supply the buyer in the event the order is secured. If the bidder is convinced that he and his goods are acceptable to the buyer and is led by good reason to believe that the buyer is considering seriously a change in his foundry connections, then the bidder can proceed to close the sale. In proceeding cautiously with this sales policy, no handicap whatever is placed on the individual foundry. The use of more modern sales tactics will be tremendous and far-reaching in their moral effect and in raising the foundry industry to the highest plane.

Collectively, all foundries constitute the foundry industry. The industry will be no more than what foundrymen make it. Wise cooperation between the members, adequate cost systems and scientific merchandising methods, will lift the industry out of the present slough of despond. Foundrymen hardly can hope to get more out of the industry than they put into it. Their destiny and the destiny of the foundry industry is entirely in their hands. Each and every foundry must be responsible for its acts within the industry.

Malleable Club Estimates Casting Cost

A discussion of estimates, led by W. F. Hoernke, and based on a blueprint furnished by the Wisconsin Appleton Co., Milwaukee, featured the regular meeting of the Malleable club, which was held at the Blatz hotel, Milwaukee, on March 8. Estimates made by the group members were much closer than on other castings previously estimated by the group. Discussion brought out the fact that a number of those present believed the job could be molded in a smaller flask than the one actually used.

L. C. Hewitt, director of research, Laclede-Christy Clay Products Co., St. Louis, showed a three-reel film, illustrating the manufacture of fire bricks, and commented on the various operations which were shown. Professor Scott Mackay, University of Wisconsin, and president of the club, presided.

MacPherran Leads Discussion on the Cupola

R. S. MacPherran, chief chemist, Allis-Chalmers Mfg. Co., Milwaukee, led a discussion on "Cupola Operation" at the regular monthly meeting of the Wisconsin Gray Iron Foundry group held at the Hotel Schroeder, Milwaukee, on March 9. Mr. MacPherran outlined the various operations beginning with the lining of the cupola, method of making up the bottom, method of lighting the cupola, method of charging, etc. Due to inclement weather and the relatively small attendance, a much greater opportunity for discussion was presented and members took advantage of that feature in making it one of the most interesting meetings of the year. Professor R. S. McCaffery, University of Wisconsin, Madison, presided.

Soda Ash Removes Impurities in Cast Iron

Surveying the field of purification of gray iron, Dr. F. W. Meyer, foundry consultant and metallurgist, Rockford, Ill., discussed cupola practice with regard to prevention and removal of impurities in the iron, at a meeting of the Chicago Foundrymen's club March 3, at the City club, Chicago.

In his lecture, Dr. Meyer demonstrated through results of a number of tests in actual practice what has been achieved and what may be expected from processes in eliminating oxides, silicates and sulphur from cast iron. His remarks were based on his studies of practices both in this country and Europe.

Advantages of chemical and mechanical methods in accomplishing this were cited. These advantages included increased fluidity of the metal, lower solidification point, decreased shrinkage and increased machinability. While the use of soda ash permits of a higher percentage of scrap in the melt, the speaker pointed out frequent errors of reducing the pig iron charge beyond the limits of sound practice, as affecting the factors of quality and ultimate cost.

Dr. Meyer emphasized the ideal combination of both chemical and mechanical processes in preventing and removing impurities. The use of soda ash in the rotary or rocking-type cupola or furnace was described.

Dangers of consequent injury to the cupola lining through soda ash application were mentioned, with suggestions as to the care of the lining to prevent injurious results. It was pointed out that the ability to pour metal at lower temperatures after purification has a favorable effect upon the appearance of the castings' surfaces. Importance of the improved machinability factor was stressed.

Besides discussing the recent more widespread applications of soda ash as a purification agent, Dr. Meyer also mentioned application of other fluxes, including additions of limestone and fluorspar. Pointing out the physical advantages of the removal of impurities in the iron, Dr. Meyer emphasized that tensile and transverse strength as well as deflection are improved thereby.

A guest at the meeting was Dr. H. A. Nipper, University of Aachen, Aachen, Germany, who is doing research in this country and has been visiting foundries before his return to Germany.

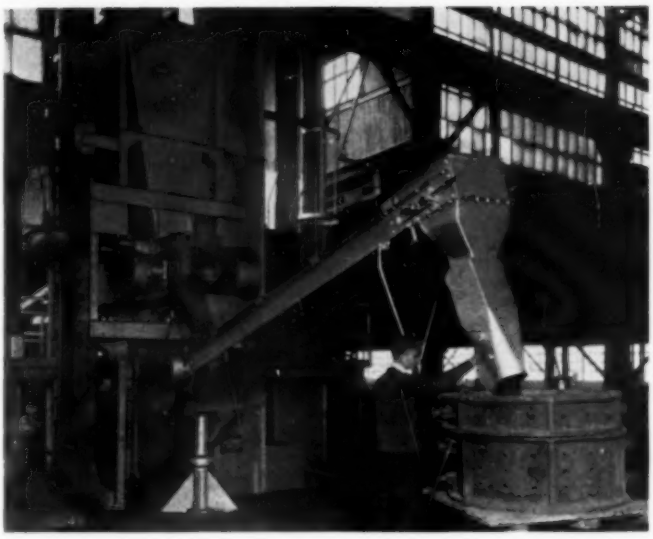
Pittsburgh Group Hears Talk on the X-Ray

The use of x-ray equipment in the foundry industry was the topic for discussion at the regular monthly meeting of the Pittsburgh Foundrymen's association on March 21 and attracted one of the largest audiences of the year's meetings. About 70 were present. E. W. Page, manager of the industrial x-ray research department, General Electric Co., presented an illustrated talk on the examination of castings by use of the x-ray. Considerable discussion on the application of this process followed his talk.

Nominations for officers of the association for next year are to be presented at the next meeting to be held April 18. The nominating committee consists of R. W. Jones, Union Switch & Signal Co., Swissvale, Pa.; A. J. Hartman, United Engineering & Foundry Co., Pittsburgh; and R. H. Stone, Vesuvius Crucible Co., Swissvale.

Form Supply Company

Klein-Farris Co., 310 Congress street, Boston, recently was organized by Herbert H. Klein, formerly with the Pennsylvania Foundry Supply Co., and Horace D. Farris, formerly with the Chas. A. Krause Milling Co., to conduct a general business in foundry supply.



A Jeffrey Flask Filler of the overhead bin type in the plant of the Massillon Steel Castings Company, Massillon, Ohio. This unit is served by a bucket elevator and feeder, which receive prepared sand directly from a muller.

A Jeffrey Flask Filler of the overhead bin type. (Sawbrook Steel Castings Co., Cincinnati, Ohio). This flask filler is served by crane and grab bucket from a central sand preparing plant, also built by Jeffrey.

Flask Fillers . . . . .

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But your condition may be different—our Jeffrey Foundry Engineers will be glad to look over your foundry operations and make recommendations without obligation.

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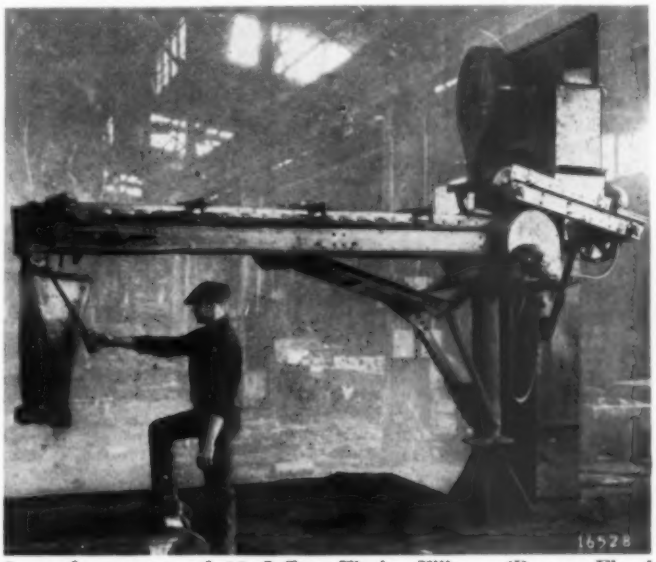

One of a group of 15 Jeffrey Flask Fillers (Bonney-Floyd Company, Columbus, O). This is an underground bin type. Note absence of piles of sand on floor.

One of a group of Jeffrey Flask Fillers in the Steel Foundry of the Standard Steel Works, Burnham, Pa. This type is without revolving boom but has a balanced, swinging chute.

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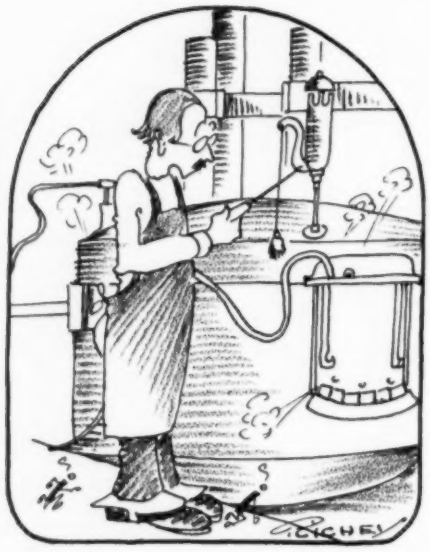


Oh! whistle an' I'll come to ye me lad

The Adventures of Bill

BY PAT DWYER

"ON THE broad general principle," Bill remarked, "that no man should approach another with the object of engaging in conversation unless assured by experience, observation, instinct or what have you, that the second man will be interested in the subject, I beg to inquire, and—er—so forth, if you are interested in the subject of mosquito extermination?"

"Valued inquiry safely to hand," I admitted, "and contents carefully noted. In reply beg to advise that I shall be very happy indeed to reopen the question in July or August. In the meantime might I suggest that you attempt to exchange your present store of experience, observation and instinct or what have you, for a glimmer of common sense. A grand time you select for talking about mosquitoes with the ground frozen as hard as a rock, with the mercury in the thermometer crouching down around the zero goal and with your chance of seeing a mosquito about as good as your chance of seeing the Shah of Persia or Sinbad the Sailor coming in the door skirlin' the pipes for *Lord McDonald* or the *Cock o' the North*."

"In time of peace," Bill waved one hand carelessly. "In time of peace, prepare for war. That's a quotation from something or another. I'll look it up some day and give you the aisle and shelf. What I mean to say is now is the time to consider—if you ever intend to consider—the mosquito menace. In July and August when these blood suckers attain their full growth, it will be too late. Consider, dear lad, the inspired words of ol' wotdayacollum: 'A mosquito in the hand—properly squashed—is more conducive to the peace of mind than 47 mosquitoes on the hoof or the wing'; or even two of these champion drillers stealthily sucking your life blood and leaving the wound full of poison. You never heard of a mosquito singing to his lady love: De-rink to Me O-o-onaly With Thine Eye-ez and I-i-l Not Ask for Wine—"

"No," I said. "He probably says, 'Hey, woman! This is work for men. Stand aside and let a guy drill as can drill!' "

"A common and wide spread error." This from Bill the oracle! "As a plain matter of fact the male mosquito is a gentle, home loving lad with charity for all and malice toward none, a teetotaller. The female is the old soak, the vampire with an insatiable appetite for gore, human gore. How do I know? I have it on the word of the General Electric Co. which, of course, as you know is responsible for many remarkable discoveries. According to a recent news release, Professor Elihu Thomson reported that thousands of male mosquitoes were cremated over a furnace last summer in which he was fusing a 66-inch quartz disk for an astronomical mirror.

"The hum of the furnace incident to the passage of a large volume of three-phase, 60-cycle energy into the resistance heaters attracted the attention of the male mosquitoes lounging in the marshes of Lynn. According to Professor Thomson, this hum is exactly similar to the noise one hears as a female mosquito flies into one's room at night. Professor George H. Parker of the department of zoology at Harvard university admitted the plausibility of Professor Thomson's explanation. The hum of the female mosquito is the love song, the mating call, the mosquito equivalent for Nelson's famous signal flying from the maintop of the VICTORY, 'This day, England expects every man to do his duty!'

Modern version of the spider and the birds that fly by night

"Male mosquitoes answered the siren call in companies, in squadrons and platoons, in regiments and divisions, in swarms that circled over the furnace and fell scorched and shriveled in the blistering atmosphere.

"The incident suggested to the professor the idea of building an electromagnetic hummer which at small expense can spread the call over a wide area and thus attract all the male mosquitoes in the vicinity. Method for trapping and afterward destroying the bodies is a point of only minor detail. They may be burned, drowned or shocked. Who cares?

" 'Certainly,' as the professor very justly points out in concluding his report, 'if the males can be destroyed, the egg laying power of the females will be—ah—seriously curtailed with a resultant diminution of the mosquito population. It is possible that a proper utilization of the principle, exemplified by an electric de-skeeterizer in every home, eventually will extinguish or at least seriously decimate the entire race.'

"There y'are," said Bill. "Think it over. In the meantime take a look at this inquiry I had from a lad who lately has taken charge of a shop and needs a friendly word to bolster up the old confidence.

I would like for you to advise me what is the best grade of pig iron and scrap to use in making cotton mill machinery castings. These castings must be perfectly clean and solid. Analysis of the pig iron we are using at present is: Silicon, 2.91 per cent; sulphur, 0.023 per cent; manganese, 0.75 per cent; phosphorus, 0.62 per cent. The scrap is old cotton machinery scrap and our own foundry returns. The regular mixture is made up of pig iron 150 pounds; old scrap, 175 pounds; and shop scrap, 175 pounds. A coke charge of 70 pounds is placed between the 500-pound iron charges. The cupola is lined to 26 to 28 inches.

The coke bed extends 36 inches above the tuyeres.

Sometimes the iron is good and hot at the first tap, but usually it is dull until the third tap. The machine shop complains of hard metal in the pulleys and other thin castings; also of small gas holes under the skin of gear blanks and other castings that have to be machined. Is the analysis wrong, or is the mixture unsuitable for clean and easily machinable castings?

I have not seen any analysis for the coke, but we get it from a reputable source. We use a good grade of sand, well mixed before it is used and the molds are well vented. I have no way of measuring the blast pressure or volume, but am submitting a sketch of the layout, motor, countershaft and fan. The fan is No. 7 made by the Buffalo Forge Co., Buffalo, N. Y. The motor with a 7-inch pulley makes 1715 revolutions per miunute and is connected by belt to a 24-inch diameter pulley on the countershaft. A 36-inch diameter pulley on the same shaft is connected by belt to the 5-inch diameter pulley on the fan.

Can you tell me how to calculate the speed of the fan? According to the manufacturer's catalog this fan must run at a speed of 3560 revolutions per minute to develop a pressure of 10 ounces and at 3880 revolutions for a pressure of 12 ounces. The cupola is equipped with four 5 x 7-inch tuyeres. An almost straight windpipe conducts air to the cupola from the fan about 20 feet away.

"A point frequently lost sight of by men of limited cupola experience is that a definite balance must be maintained between the volumes of air and coke and the diameter of the cupola. Each cupola has a limit beyond which it cannot be pushed irrespective of the amount of fuel or volume of air supplied. In the cupola under discussion the diameter is given as 26 to 28 inches. That is too indefinite a figure since it indicates a possible variation of 1000 pounds per hour in the melting capacity.

"Under ideal conditions a 26-inch diameter cupola will melt 5000 pounds of iron per hour while under the same conditions a 28-inch diameter will melt 6000 pounds in the same period of time. Manifestly the ideal volume and pressure of blast for one is not suitable for the other. Also in the present instance the pressure is too high and the volume is too great for either a 26 or a 28-inch diameter cupola. That factor accounts for the dull iron at the first, for the gas holes in the castings and for the hard iron.

"The remedy for all these troubles is to reduce the blast. This can be done by changing the size of the driving pulley on the countershaft, or, by installing a gate in the blast pipe. According to the manufacturer's catalog, the blower now in use delivers 1640 cubic feet at 10 ounces pressure while operating at a speed of 3560 revolutions per minute. That would be 140 cubic feet per minute in excess of the requirement of a 28-inch cupola and 390 cubic feet per minute in excess of the amount required for a cupola 26 inches inside diameter. In addition to the foregoing, the data submitted on the present installation indicates that the fan is running at a speed of 3600 revolutions per minute and that means further increase in the amount of air delivered.

"If a gate is installed in the blast pipe, it may be adjusted at the right point following experiment on a few heats. For positive results and intelligent control over the operation of the cupola the inexperienced man should have two gages, one to record the pressure and the other to show the volume. An experienced melter knows by the sound, by the intensity of a jet escaping through a peep hole, by the appearance of the coke inside the tuyeres, by the temperature of the iron and by other more or less indescribable features, whether the blast is satisfactory or not.

"However, this is a form of knowledge that only can be acquired over a long period of close application and for that reason gages should be installed on all cupolas.

"Exceptions due to abnormal conditions may be noted occasionally, but the composite experience of many men indicates that a pressure of from 6 to 8 ounces is sufficient for a 28-inch cupola and a volume of 1500 cubic feet per minute is sufficient to meet the maximum melting capacity.

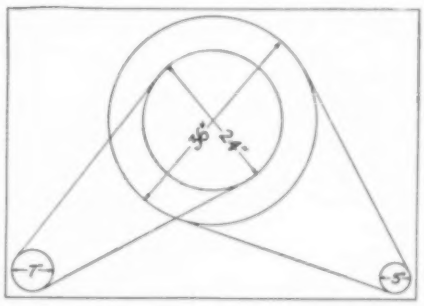


Diagram showing relative positions of belts leading to motor and fan

"The following rule for calculating pulley speeds is taken from the *Foundrymans Handbook*, a veritable mine of information, tables, rules on practically every phase of foundry operation: The number of revolutions per minute of a driven pulley is equal to the product of the revolutions per minute of the driving pulley and the diameter of the driving pulley in inches, divided by the diameter of the driven pulley. This may be reduced to the formula

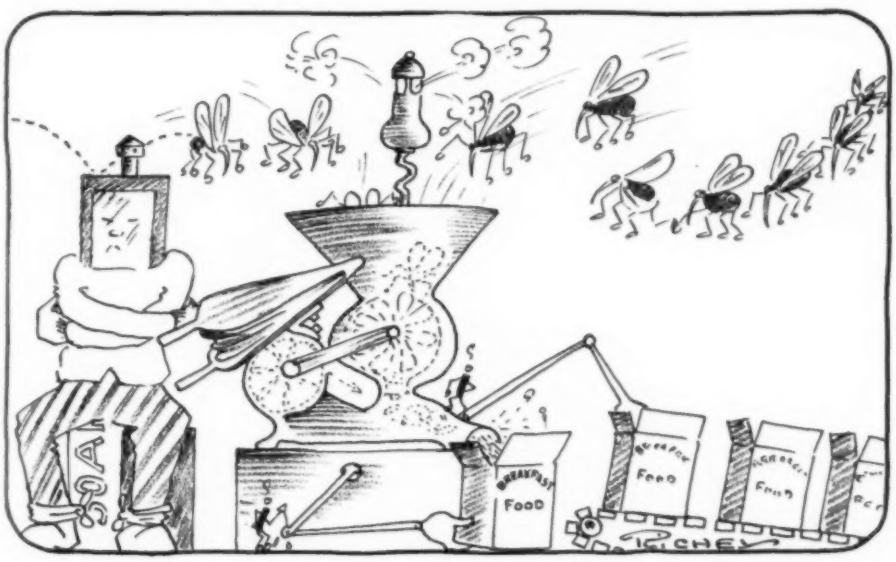
$$R = \frac{dn}{D}$$

in which R represents the revolutions per minute of driven pulley, n the revolutions per minute of the driving pulley, D the diameter of the driven pulley and d the diameter of the driving pulley.

"Substituting figures in the present instance for the letters of the formula we have: Revolutions of the driven pulley equals (1775 X 7) ÷ 24, or, 500. Naturally if the 24-inch pulley on the countershaft is running at 500 revolutions per minute, the 36-inch pulley on the same shaft is making the same number of revolutions.

"The same process is gone through again to find the number of revolutions of the pulley on the fan. In this instance the 36-inch pulley is the driving pulley and is running at a speed of 500 revolutions per minute. Therefore the number of revolutions of the driven pulley is: (500 × 36) ÷ 5, or, 3600.

"It is possible that wet sand in the bed, or too short a time between lighting the fire and putting on the blast, may be contributory factors toward the cold iron in the first few taps, but the principal cause of the trouble is excess blast. The fan should be throttled down in some manner, the lining and bottom of the cupola should be hot before the wind goes on.



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An Iron Foundry Story

(*Concluded from Page* 43)

which is merely theory and not established by sound practice. Our speaker for this session has been selected in accordance with this policy. Most of you know him; all of you know of him. After seven years in our faculty as professor of metallurgy he organized his own foundry company which has been an eminent success. I shall turn the meeting over to Mr. Heeber, as he prefers to be called, president of the Heeber Foundry Co., but still our own Dr. Heeber."

The great authority on high test cast iron rose amid great applause. But he lost no time in getting under way.

"In the first place, I must say once more that high test iron is an indefinite term, used to designate a considerable variety of foundry products. I shall tell what I mean by the term, I shall then point out the properties of the iron and finally explain how we make it."

For half an hour he spoke and there was no sound in the room except his voice, and the rustle of paper and the scratching of pens and pencils as the foundrymen frantically made notes. For another half hour they plied him with questions. When the session adjourned practically everybody remained and asked more questions. It became dark but their enthusiasm kept up until a janitor appeared and suggested that it was time to go by rattling his keys and closing the windows with unnecessary noise. When they finally went to dinner they walked in groups in which two or three eagerly talked at once.

Chapter III

William Ward, the chief engineer of the Greer Machine & Power Co., sat in Rufus Dixon's office and the two of them studied a pump cylinder drawing which Ward had brought. The Greer Co. was Dixon's largest and best customer. He understood their work and did it well and made money on it. They, in turn liked his castings and his service and the arrangement was highly satisfactory to both parties. The cylinder looked to Dixon like the finest job he had ever had. Forty-five castings were required every day and there were 25,000 on the order, in three lots. The two men had gone over the drawing thoroughly and had discussed the necessary pattern equipment and the rigging for the required daily production. Then Dixon's troubles began.

"Now about the quality of the metal," said Ward. "The pumps are subject to severe pressures. We'll have to have a tensile strength of 50,000 pounds and the castings will have to be absolutely leak proof. If they don't come up to those requirements we can't take them; and the inspection will be extremely rigid. You'll have to make the job in that low carbon stuff, high test iron you fellows call it. Now, what price can you make us on the job?"

Dixon looked puzzled, incredulous and angered in turn as Ward spoke.

"There ain't no such thing as gray iron with tensile strength of 50,000 pounds. What are you talking about? The best you can get with fancy iron is about 30,000 and you got to pay plenty for that," he protested in a tone of voice which suggested that Ward had better go back home, find out a thing or two about gray iron and then come again.

It was Ward's turn to be surprised. He raised his eyebrows, "I know the requirements are a bit strenuous," he agreed. "But high test iron is made up to about 50,000 pounds; not in every foundry, I'll admit, but the better shops make it and I should think you could too. Our competitors get this kind of iron from their foundries and we ought to be able to get it from you."

"You fellows have been good to us and we'll give you everything in reason but we don't cast iron with tensile strength of 50,000 pounds and nobody else does either, not commercially. Maybe some college guys and laboratory bugs make that kind of iron but it ain't being done in a shop; no matter what they tell you."

Ward soon realized that nothing remained except to discard the discussion as tactfully as possible. "Well, sir," he said, "I must have been mistaken. Perhaps I haven't got the data correct but my reading and investigation had given me the impression that iron of such high tensile strength and density was quite feasible."

Then they talked briefly about some of the jobs Dixon was making for Greer at the time and soon Ward took his hat and went out.

Chapter IV

When Walter Pace, manager of the South End Foundry Co., returned from the foundry school at the institute with his notebook under his arm he was all enthused over the possibility of high test iron. He studied everything he could find on the subject and then bought himself a pair of overalls and a denim jacket and for weeks spent nearly all his time about one of the cupolas, experimenting with linings, tuyere areas, blower pressures, temperatures, charges.

The president of the company and even the superintendent called him crazy and laughed at him but nothing could shake his determination and with infinite care he melted and poured test pigs and arbitration bars day after day. And when they were shaken out he took them to the laboratory where they were drilled and broken and subjected to every conceivable kind of test to determine chemical, physical and mechanical properties.

And finally he had an iron which was dense, perfectly homogeneous and had a tensile strength of 50,000 pounds per square inch. It was no chance result; he had an accurate record of just how it was made. He was in the office of the president who examined the test records of the final specimens. Then the president laid the papers down on his desk, looked up and asked, "Now that you've got the stuff what are you going to do with it? Who wants it? Nobody I know of."

Pace shrugged his shoulders. "I don't know anybody who wants any just now but it's the trend and the tendency and one of these days we'll be mighty glad we know how to make it."

They did not have long to wait. Two days later William Ward of the Greer Machine & Power Co., came to see Pace and made the same proposition he had made to Dixon.

Pace was jubilant. A test mold was made under his direction and poured in his new, high test iron and the casting was sent to the Greer plant for tests. A trial order of 12 castings was then made and delivered and Pace went down to the Greer shop to see them tried out. When he returned he jumped out of his car and hippety hopped into the office like a school boy returning home from a football game which went his way. He waved a paper over his head in high glee. It was an order for 25,000 cylinders, the biggest single order his foundry ever received.

Epilogue

Within 2 years after the events just narrated, Rufus Dixon passed out of the foundry business, like people do, who fail to see that the world keeps moving. He took to selling life insurance and then he did have to go to school—in the home office of the insurance company. Apparently he has lost his ability for absorbing knowledge, or refuses to learn, because he doesn't sell much insurance. They say you can't teach an old dog new tricks.

Patterns Rule Molding Methods

(*Concluded from Page* 35)

benches along the wall by the windows and the machines in the center of the room.

Fig. 8 shows some special milling machines on which the milling heads are considerably higher than those ordinarily employed in machine shops. The higher head location allows the machine to be used on work of greater height than is usual. Milling operations on both machines are being conducted on aluminum patterns for a transmission cover for a tractor. The pattern in the background is for the cope and weighs about 380 pounds. The pattern in the foreground is for the drag and weighs about 458 pounds.

It often happens, especially with automotive patterns and core boxes, that a number of each has to be made. They can be made by hand, and many are produced in that manner, but even when they are made by the same workman the results obtained are not identical although they are entirely satisfactory for molding purposes. However, through the use of special automatic machines it is possible to produce duplicates of the original that vary only 0.002-inch from its dimensions.

Duplicates Made Rapidly

One of those machines supplied by the Keller Mechanical Engineering Corp., New York, is shown in Fig. 2. The machine is cutting the contours in a manifold core box. The original core box made by hand is mounted at the top of the platen, and the duplicate is mounted below. A round-nosed tool visible at the upper left presses against the face of the original corebox and follows the contours moving forward and back with depressions and projections as the case may be.

The movement of the top tool is transmitted to the cutting tool shown at the lower left, and every forward or backward motion, no matter how slight, is reflected in the action of the cutting tool. As may be realized, the automatic features of the machine produce a great saving in hours of time to do a certain job as once the original piece and that for the duplicate are set up, the operator has only slight adjustments to make from time to time. The automatic features of the machine allow the duplicate piece to be machined rapidly with extreme accuracy.

Fig. 5 gives some idea of the variety of small patterns produced at the City Pattern Works. The illustration shows a group of matchplates constituting one order from a large automotive manufacturer. The plates are aluminum, and as may be observed, are for extremely light castings forming a part of the modern automobile. The other extreme in patterns is shown in Fig. 3 which is for a tractor crankcase. It is mounted in a 42-inch lathe to receive one of the numerous machining operations that are required, as the pattern is machined all over.

The tractor crankcase pattern is made of iron, and with its stripper and stools will weigh 4200 pounds. In addition 2500 pounds of iron coreboxes and dryers are required for the complete job. Of course, it is hardly necessary to say that the master wood pattern with its double shrinkage allowance was the first step in producing the final iron pattern, and that also was made in the shop.

The final inspection is one of the most important operations in the modern pattern shop. Every dimension must be checked carefully to see that it conforms to those desired by the customer. Any variation, no matter how slight, must be noted, and its effect considered from the foundry viewpoint. Finished patterns, coreboxes and dryers are inspected in a separate room from the patternshop but adjoining it. The inspection room is shown in Fig. 6. As may be observed the various jobs are placed on tables of different heights which allow the inspectors to perform their duties easily and rapidly. The tops of the tables are heavy cast iron plates which have been machined accurately to give a perfectly level surface. Equipment of the inspection department includes various measuring devices for maintaining accurate inspection.

Machine Head Is High

Fig. 4 shows a machining operation being conducted on a milling machine. As may be observed, the milling machine is specially designed with an extremely high head, considerably higher than the milling machines shown in Fig. 8. The device being machined is one-fourth of a transmission case and is made of cast iron. It is machined all over and weighs about 800 pounds. The complete cast iron pattern weighs about 7000 pounds including the plates, side frames, etc. In addition 4000 pounds of aluminum core boxes and dryers are included in the job.

Mention has been made previously that the firm operates its own foundry for producing its nonferrous castings, but has the iron patterns made outside. The management of the City Pattern Works takes considerable pride in its foundry for not only in the quality of castings turned out, but also for the cleanliness under which operations are carried on. While it hardly can be expected that molding operations can be conducted as cleanly as those in patternmaking, a surprising change in appearance may be made through keeping the gangways clean, etc.

To that end the firm uses the roof over the foundry as a storage for all flasks not in use. The gangways are maintained as clean as possible, and all refuse and waste sand is removed from the foundry and elevated to a bin on the roof.

As may be expected, most of the castings produced are made of aluminum alloy. However, many bronze and brass castings also are produced in the foundry. Alloys for the various castings are melted in oil-fired furnaces located at the extreme end of the L-shaped foundry. The furnaces include 6 pit-type crucible furnaces, 1 tilting crucible furnace of 1000 pounds capacity, and 3 iron pot furnaces for melting aluminum only. An overhead trolley system extends from the furnaces to the shipping room with side tracks to the molding floors. That eliminates double handling as the molten metal or the finished castings are conveyed on the one system from any part of the foundry to the other, or into the shipping room.

High Strength Iron Features Quad City Meet

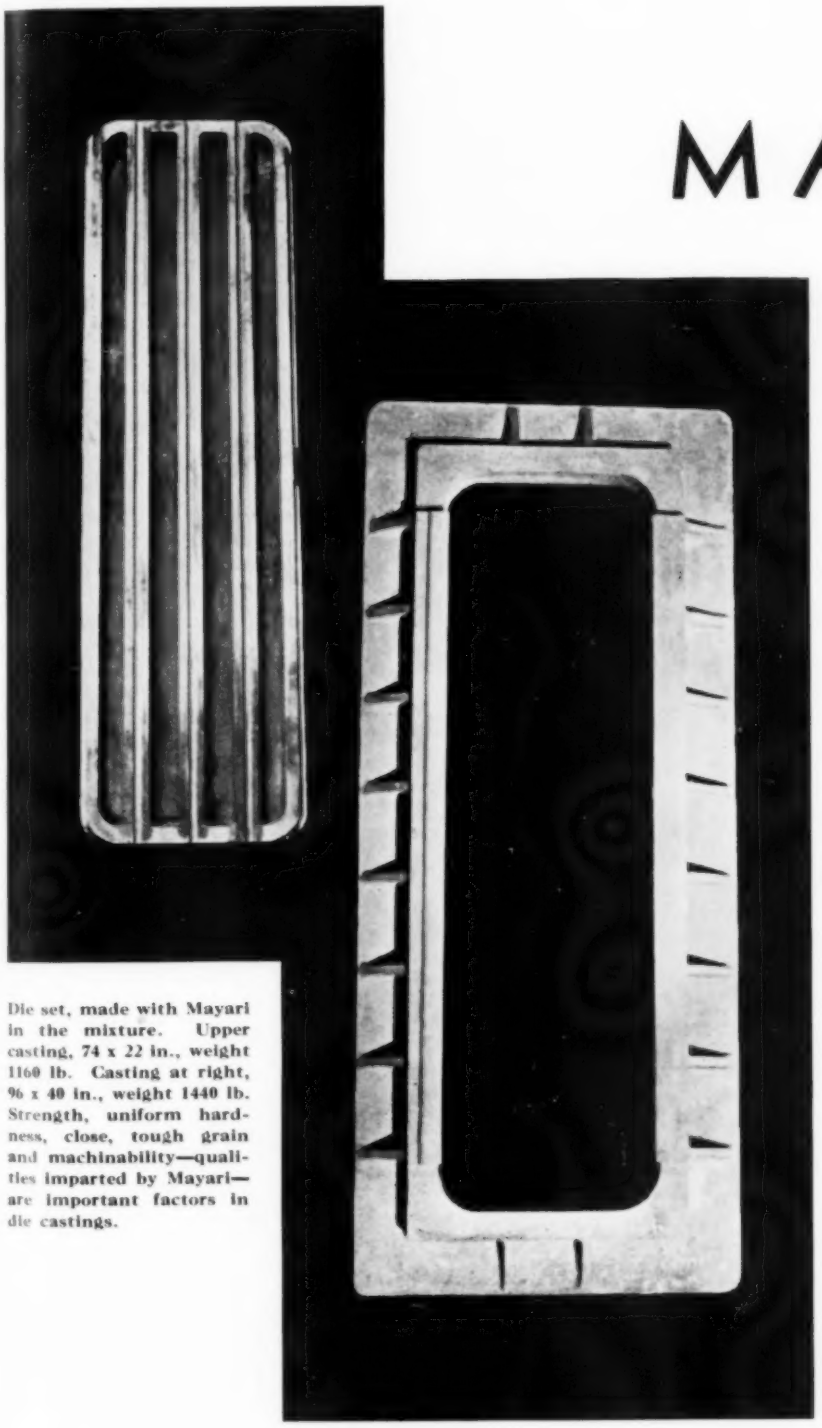
Erwin J. Mohr, vice president and works manager, Gunite Foundries Corp., Rockford, Ill., spoke on "High Strength Iron" at the regular meeting of the Quad-City Foundrymen's association held March 21 at the Fort Armstrong Hotel, Rock Island, Ill. Harold Markuson, formerly in charge of heat treating, John Deere Plow Works, and recently returned from Russia, where he was employed by the Soviet government at the Rostov on Don plant, which manufactures farm implements, gave a short talk on his recent experiences in Russia.

A nominating committee was appointed to prepare a report for presentation at the April meeting. The election of officers will be held at the May meeting.

Malleable Group Holds Annual Meeting

The quarterly meeting of the Malleable Iron Research institute was held in Cleveland March 17. E. E. Griest, Chicago Railway Equipment Co., Chicago, president of the institute, presided at the sessions. Prof. Enrique Touceda, Albany, reported on progress in technical lines. Reports also were given by Robert E. Belt, secretary-treasurer, and Herman H. Lind, Cleveland. James A. Emery, general counsel, National Association of Manufacturers, Washington, addressed the luncheon meeting.

Reduce Defective Casting Losses with MAYARI



Die set, made with Mayari in the mixture. Upper casting, 74 x 22 in., weight 1160 lb. Casting at right, 96 x 40 in., weight 1440 lb. Strength, uniform hardness, close, tough grain and machinability—qualities imparted by Mayari—are important factors in die castings.

Losses due to the premature failure of castings in service and to rejections in machining due to internal defects, can be largely eliminated by the use of Mayari.

The presence of Mayari in the mixture imparts to castings a strong, tough, close-grain structure, freedom from shrinkage cavities and porosity; high, uniform hardness; increased resistance to heat and wear; and greatly improved machinability.

Mayari, a natural nickel-chromium alloy pig iron, is simple, effective and economical to use. It is added direct, as part of the regular charge in the cupola, resulting in a thorough distribution of the alloying elements in the casting mixture.

In addition to better castings, with fewer rejections and lower scrap losses, greatly improved foundry operations follow the use of Mayari. When Mayari is present in the mixture, the molten metal has greater fluidity and lower freezing point, and consequently longer life in the ladles.

Bethlehem foundry specialists will be glad to explain in detail the many advantages derived from Mayari, and to discuss its application to the castings you make or use.

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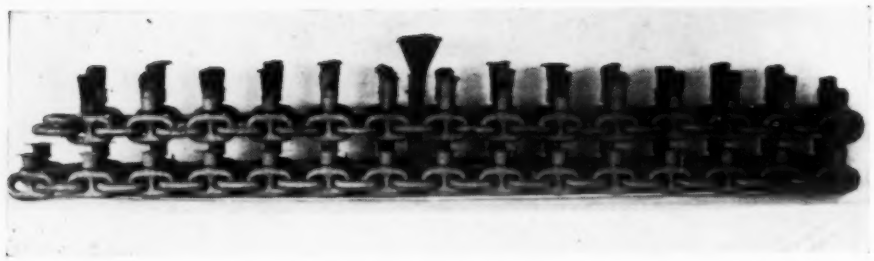

Fig. 2—An interesting method has been developed for casting steel chain

Cast Steel Anchor Chains

(*Concluded from Page 46*)

in their car coupler knuckles. The steel is harder and much less ductile than wrought iron, having tensile strength up to 120,000 pounds and elongation up to 18 per cent. Tests demonstrated that chain made from that material was not deformed under stresses which caused a prohibitive degree of distortion in wrought iron chain.

The navy obtained a quantity of cast steel chain from the National Malleable & Steel Castings Co. and placed it in service on naval vessels for test. Although the chain had shown excellent qualities in shop tests, it was felt that a material which differed so radically from that previously used should be tested thoroughly in service, prior to its adoption as a standard for naval vessels. At that time the persistent failures in wrought iron chain and the apparent difficulty in correcting these weaknesses led to an investigation to determine.

1. The effects of annealing of chain; whether the practice of periodically annealing is beneficial or otherwise.

2. Whether there existed any relation in the failure of chain between the "short" fracture and the annealing and proofing.

Test for Superiority

The scope of the investigation also included determination of whether cast steel chain, as manufactured by the National Malleable & Steel Castings Co. was superior to wrought iron chain in resistance to those forces which were known to cause wrought iron chain to fail in service. The tests were conducted over a period of 3 years beginning in 1921 at the Boston navy yard, and the yard reported that the National Malleable & Steel Castings Co. cast steel link had been compared with the navy standard wrought iron link with the result that the cast steel link was found definitely superior in resisting both repeated loading and repeated shock.

The favorable showing of cast steel chain against those particular forces which are known to break wrought iron chain in service, together with its other previously known superior properties—namely, its uniformity in dimensions, homogeneity of material, and the integral stud—led to a final decision that cast steel chain should be adopted as the standard for navy use, gradually to replace wrought iron chain.

The use of cast steel chain by the navy over a period of 10 years has demonstrated that periodic annealing is not necessary as for wrought iron and, consequently, the cost of maintenance of cast steel chain is much less than that of wrought iron chain. Cast steel chain is acceptable under Lloyds and the American bureau of shipping rules, and large quantities of that chain have been used by commercial vessels. It is also used by the navy for marine railways. The industry readily lends itself to expansion in case of emergency, while the manufacture of wrought iron chain requires highly skilled labor.

Castings Are Better

WHEN the war created an enormous demand for ships, and every yard in the country was operating at maximum capacity, the navy department found it necessary to locate new sources for anchor chain, since facilities and experienced personnel for producing welded iron anchor chain were inadequate to meet requirements. Experiments were conducted with cast steel chain and that product was found satisfactory, being used extensively at that time.

Later tests were conducted which revealed cast steel chain superior to the wrought iron chain, previously used, in resistance to failures in service. Also the cast steel chain does not require periodic annealing. This article is from a paper on "Notes on the Development of Certain Materials Used in Ships of the U. S. Navy" and was presented before the New York meeting of the Society of Naval Architects and Marine Engineers last November. The author is chief constructor, U. S. navy.

Nickel Discussed At New England Meeting

The regular monthly meeting of the New England Foundrymen's association, held at the Engineer's club, Boston, on Wednesday, March 9, featured a discussion of "The Application of Nickel to Cast Iron," by E. J. Bothwell, International Nickel Co., New York, and C. E. Birch, Whitehead Metal Products Co., Boston, and a talk on "The Application of Nickel in Nonferrous Alloys," by William Sweet, International Nickel Co., New York. The discussion of cast iron was illustrated with lantern slides.

A motion was voted unanimously in both the executive and open session of the meeting, that the association extend to the Secretary, Fred F. Stockwell, Barbour-Stockwell Co., an expression of sympathy in his illness. R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston, was appointed chairman of a committee to arrange for transportation in connection with the convention of the American Foundrymen's association. Leroy Sherwin, president of the association, presided.

Produce More Gray Iron in February

Production of gray iron castings by members of the Gray Iron institute during February was on the basis of 39.4 per cent of normal compared with 37.8 in January. New business for the month gained 2 per cent over January with a total of 39.4 per cent of normal.

The recent report of the Gray Iron institute shows that the greatest increase in activity was experienced in the territory including Wisconsin, Illinois and the area west of the Mississippi river and south to the Mexican-United States border. The Chicago district showed a gain of 3 per cent, ranking second. Production by normal volume indicates that those plants with the normal production of from 1 to 100 tons per month experienced the greatest activity in February.

J. C. Fitzpatrick, former district sales manager of the Chicago Pneumatic Tool Co., at the Cleveland office, has been transferred to New York, and will be associated in the sales capacity.

THE TURNING POINT!

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NATIONAL ENGINEERING COMPANY

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CHICAGO, ILL., U. S. A.

Titanium Aluminum Bronze

(*Continued from page* 45)

in appearance and in strength. A second test then was run consisting of 99.5 per cent calcium. There was a lot of dross on top of the metal before it was cast, and some was left in the crucible. The sand casting was fairly clean outside but when broken showed a fibrous, crystalline structure. The crystals were arranged through the bar in the form of a cross. The copper was hardened considerably by the calcium, but the alloy is not one that can be used commercially.

This alloy was remelted with an equal amount of copper, thus halving the calcium, making it 0.25 per cent. This made little improvement. Next it was turned into a 10 per cent aluminum bronze and 0.25 per cent of magnesium added, but this resulted in a porous casting as mentioned in the previous article. The experiments were carried on until it was proved that calcium in aluminum bronze should be held low and that 0.05 per cent would likely harm the bronze. Consequently, the degasifier was formulated on that basis.

Use Calcium Carbide

Various other experiments were carried out with aluminum bronze to discover some way of improving its casting qualities. While the degasifying alloy helped matters considerably it was far from perfect, and a search for something better was continued. Good results were obtained in using calcium carbide in melting the copper. The carbide was powdered and mixed with calcined borax. One per cent of the mixture was charged into the bottom of the crucible with the copper, and the latter was melted on top of the carbide. Before the aluminum was added, the copper was stirred well to bring the carbide up through the copper. After stirring, the aluminum was added and then the iron.

Use of calcium carbide produces fine, clean castings, and makes a satisfactory substitute for the degasifying alloy. Usually the skimmings of carbide can be used over again after screening to remove the larger particles, and mixing with a small amount of new carbide and borax. When the skimmings are discarded, they should be thrown into half-barrel filled with water somewhere outside the foundry as acetylene gas is generated when the skimmings are moistened.

Application of the degasifying alloy was entirely responsible for the introduction of iron into aluminum bronze in definite proportions, and for a definite purpose. Iron never had been added before as a constituent, and its addition formed a ternary alloy of copper, iron and aluminum in the case of the 88-10-2 alloy. A modification of that alloy contains 88.25 per cent copper, 9.75 per cent aluminum, 1.50 per cent iron, and 0.50 per cent of the degasifying alloy.

The physical properties show a yield point of 23,800 pounds per square inch; ultimate strength 75,100 pounds per square inch; elongation 25 per cent in 2 inches; and reduction of area 24.9 per cent. With the alloy containing 89.50 per cent copper, 1 per cent iron, and 9.5 per cent aluminum, the yield point was 21,900 pounds per square inch; ultimate strength 69,800 pounds per square inch; elongation 39.5 per cent in 2 inches; and reduction of area 37.5 per cent. In compression the elastic limit was 16,000 pounds per square inch, and the specimen compressed 18.5 per cent under a load of 100,000 pounds.

Physical properties of the binary alloy of 89.50 per cent copper; and 10.50 per cent aluminum in sand made castings are approximately as follows: Yield point, 25,267 pounds per square inch; ultimate strength, 68,500 pounds per square inch; elongation, 14 per cent in 2 inches, and reduction of area, 15.7 per cent. A fair average for the 10 per cent alloy is: Yield point, 20,800 pounds per square inch; ultimate strength, 61,100 pounds per square inch; elongation, 12.5 per cent in 2 inches and reduction of area, 12.0 per cent.

Has Good Qualities

The 11 per cent aluminum bronze has some good qualities and it has been claimed that it is superior to all other compositions for resistance to weak solutions of sulphurous acid, but the 7 per cent alloys were best for acetic acid, aluminum chloride and sulphate, ammonia liquors, ammonium chloride, phosphate, sulphate and sulphide, barium chloride, boric acid, calcium hypochlorite, carbon tetrachloride, cyanides, ferrous chloride and sulphate, etc.

There is no noticeable difference in casting the various alloys of aluminum bronze as variations in the content of aluminum or additions of iron make no observable difference in the foundry. The difficulties caused by piping and shrinkage of heavy sections, the formation of drossy metal, *draws* in the corners, cavities in the gates or risers, and the pear-shaped holes under the skin all are likely to be present, no matter what additions are made to the bronze.

Some metals accentuate the casting difficulties and of these manganese is an example. When considerable manganese is added, hair cracks in the skin of the casting become frequent, and alloys containing copper, aluminum, iron and manganese are more difficult to cast than the ordinary alloys of copper and aluminum, or copper, aluminum and iron.

Another difficulty that confronts the founder of aluminum bronze is the heavy drop in physical properties caused by *self-annealing* in the case of massive castings, and that is so serious a difficulty that certain alloys of copper and aluminum never should be used for any but small castings unless they are so made they can be cooled with great rapidity. These alloys comprise those containing from 9 to 11 per cent aluminum, and up to 2.5 per cent iron, as well as those within the same aluminum range, but containing no iron.

Piping and shrinking difficulties can be traced to the same origin, namely insufficient feeding of the castings. Bronze requires as much feeding as steel or copper, and considerably more than manganese bronze. It is necessary to put heavy risers on all thick sections, or to chill the castings so the section will solidify before the risers or feeders become frozen.

Flow Metal Quietly

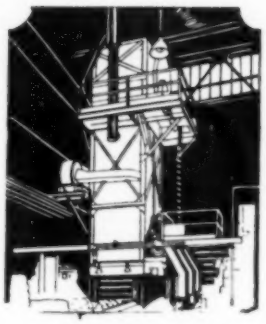
To get a nice, clean and sound casting of aluminum bronze, all that is necessary is to flow the metal into the mold in a quiet even stream, so it fills the mold evenly without the least agitation. The casting must start to solidify before the reservoir of metal in the riser, which must feed, or supply liquid metal during the period of solidification. In some cases it is not possible to feed the casting from a feeder, and not leave a pipe. However, the pipe can be filled if a slight stoppage is made in pouring. Afterward, pouring is resumed, gently, and specially large risers located strategically are filled slowly by the molten metal flowing through the pipe at a temperature just high enough to prevent sudden freezing.

A riser on either end, slightly exceeding the diameter, of solid bushings, 3 or more inches in diameter, and 12 or more inches in length will not insure a sound bar. Usually a pipe like a pencil sharpened at both ends will form in the middle of the bar. Such piping can be avoided by gating in the center of the bar length, using a riser offset from the bar, and slightly larger in diameter than the bar. A gate of about the same area as but not necessarily the same shape of the riser is cut half in the cope and half in the drag.

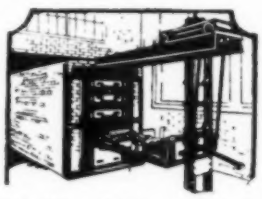
Metal must not be poured down that riser or feeder. It is best to locate a sprue near one end of the bar and in line with the riser. Use a

(*Concluded on page* 84)

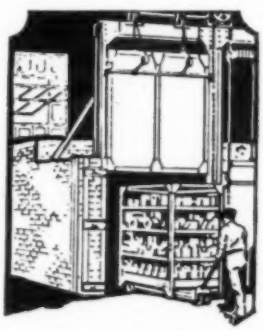
The Largest Foundry Oven Organization



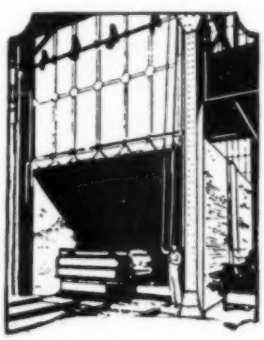
Continuous Ovens



Rolling Drawer Ovens



Rack Type Ovens



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(*Concluded from Page* 82)

horn gate, reversed into the root of the riser, and connect the horn gate and the sprue by a narrow channel. The metal drops down the sprue, and flows along the channel where due to the gradual widening of the passage, it emerges into the root of the riser quietly and easily. The method is quite different from red brass or bronze practice, but it will insure sound castings of the shape mentioned in aluminum bronze.

Shrinkage can be controlled by chills. They must be applied so that the casting solidifies before the risers. For instance, a solid cylinder 6 inches in diameter and 8 inches high will be gated from the bottom in aluminum bronze. An all sand mold will require a riser on top of the casting of practically the same diameter as the casting, and at least twice as high. Even then it will be found advisable to *pump* the riser, filling it up with hot metal to insure a sound casting.

However, if a number of those castings are to be made, it will be profitable to make chills of graphitic carbon. The two pieces forming the chill must be heavy enough to give a thickness of about 6 inches around the entire cavity. Otherwise, the chill will be ineffective. The chill is used in a three-part mold. The drag and cope molds are made in green sand and are plain. The chill is rammed up in the cheek. The cheek flask must be large enough to allow placing the sprue between the flask wall and the chill. A gate is cut in the drag from the sprue to the mold cavity, and it should be deepened to about twice its thickness where it passes under the chill.

Use Heavy Riser

The cope should be deep enough to allow for a 6-inch riser about 4-inches in diameter which is placed over the center of the chill cavity. The sprue, naturally is extended the same distance through the cope. The cope should be left off until the mold is to be poured. A few minutes before pouring, a couple of red hot ingots should be laid across the top of the chill. The graphite chills will absorb heat quickly, and the mold should be poured while the chills are still hot.

The chills may be used over and over again. However, since they are fragile, care must be exercised in their handling. Graphitic carbon may be drilled or machined easily, and its use will enable the production of aluminum bronze castings that otherwise would be difficult to make. For example a carbon chill applied on one side of a heavy casting will allow production with risers no larger than those used with gun metal. While the first cost of the chills is high, they will last a long time with reasonable care.

Graphitic carbon chills absorb moisture from the sand, and as previously mentioned they must be heated before the mold is poured. However, it is not difficult to heat the chills as they absorb heat rapidly. An aluminum bronze casting chilled with carbon blocks cools rapidly, and there is no danger in shaking out such castings while they still are at a bright red heat. In fact that should be done, and in some cases the castings should be plunged into water to obtain as rapid cooling as possible. That will prevent self-annealing due to slow cooling, and its subsequent loss of physical properties.

Facing sand composed of equal parts of old sand and new sand should be used on the green sand portion of the mold cavity not protected by the chill. The sands should be mixed dry and then a solution of water glass added until its consistency is that of rather damp molding sand. Also wet the chill with the water glass solution at those points where it comes in contact with the facing sand. That is necessary to prevent excessive drying out and crumbling when the chills are heated.

This is the second and concluding article on the development and founding of titanium aluminum bronze. The first article appeared in the March 1 issue.—The Editors.

Review Safety Effort At Cincinnati Sectional Meeting

HANDLING objects is more dangerous than speeding machinery in Ohio foundries, George Seyler, works manager of the Lunkenheimer Co., Cincinnati, declared before members of the Ohio Foundries association at their first 1932 sectional meeting in the Hotel Gibson, Cincinnati March 15. Mr. Seyler, speaking on "Practical Application of Accident Prevention" was the main speaker at a meeting which began with a six o'clock dinner.

He pointed out that only 24 per cent of the accidents are due to machinery. Twenty-nine per cent of all accidents are due to handling objects and 27 per cent are due to handling hot and corrosive materials. From the causes of accidents, Mr. Seyler's talk shifted to the dangerous hours. An analysis of accidents made by the speaker reveals that 2:30 Friday afternoon in December is the most dangerous period of the year. The order in which accidents occur during the day are 2:30 in the afternoon, 10:30 and 9:30 in the morning, 3:30 in the afternoon, 11 o'clock in the morning and four o'clock in the afternoon. By days it is Friday, Tuesday and Monday while by months it is December, July and May.

Pointing out that foundry owners would not maintain dangerous and unguarded machinery, Mr. Seyler raised the question of why human hazards should be kept on the pay roll. There is a definite reason for all accidents. The question is why did it happen, not how he declared.

Other speakers were E. I. Evans, actuary for the Ohio Industrial commission, Dr. W. E. Obetz, medical director for the commission, Dr. J. A. Turner, Worthington Pump & Machinery Corp., Cincinnati, secretary, Cincinnati Foundry Safety council and Robert Hoierman, Cleveland, Ohio Foundries association.

Mr. Evans outlined the plan under which the state compensation is administered, pointing out the reasons why insurance rates are increased, being due to three things, reduced employment, increased number of claims and increased compensation as allowed under the recently adopted compensation schedule.

Speaking on the importance of first aid treatment for all accidents, Dr. Obetz pointed out that foundrymen can save $150,000 a year by eliminating infection. Briefly reviewing state accident records, he stated that while the number of accidents decreased from 9012 in 1930 to 5766 in 1931, the fatalities increased from 26 to 28. Dr. Turner spoke on the Cincinnati Foundry Safety council showing how foundries staged a recent campaign and 72 per cent of the participating companies had no lost time accidents.

The meeting was under the direction of Ray Redmond, Buckeye Foundry Co., Cincinnati as chairman. It was preceded by a meeting of directors during which the results of the state wide safety campaign were reviewed and plans for future activities were discussed.

Mansfield Heads List

A total of 479 reports received since the campaign was launched Nov. 1, show a total of 166 accidents during 4,330,580 man hours worked, giving a state average of an accident for each 26,690 man hours.

Forty-four cities taking part in the campaign are evenly divided, 22 cities reporting no accidents during the 3 month period. Ten of the 22 reporting accidents, are above the state average. Mansfield heads the list with 330,425 man hours per accident. Newcomerstown is second with 108,975 man hours per accident while Lima is third with 64,519. Cincinnati's average is 34,266 man hours, Columbus 33,266 and Cleveland 22,331 man hours.

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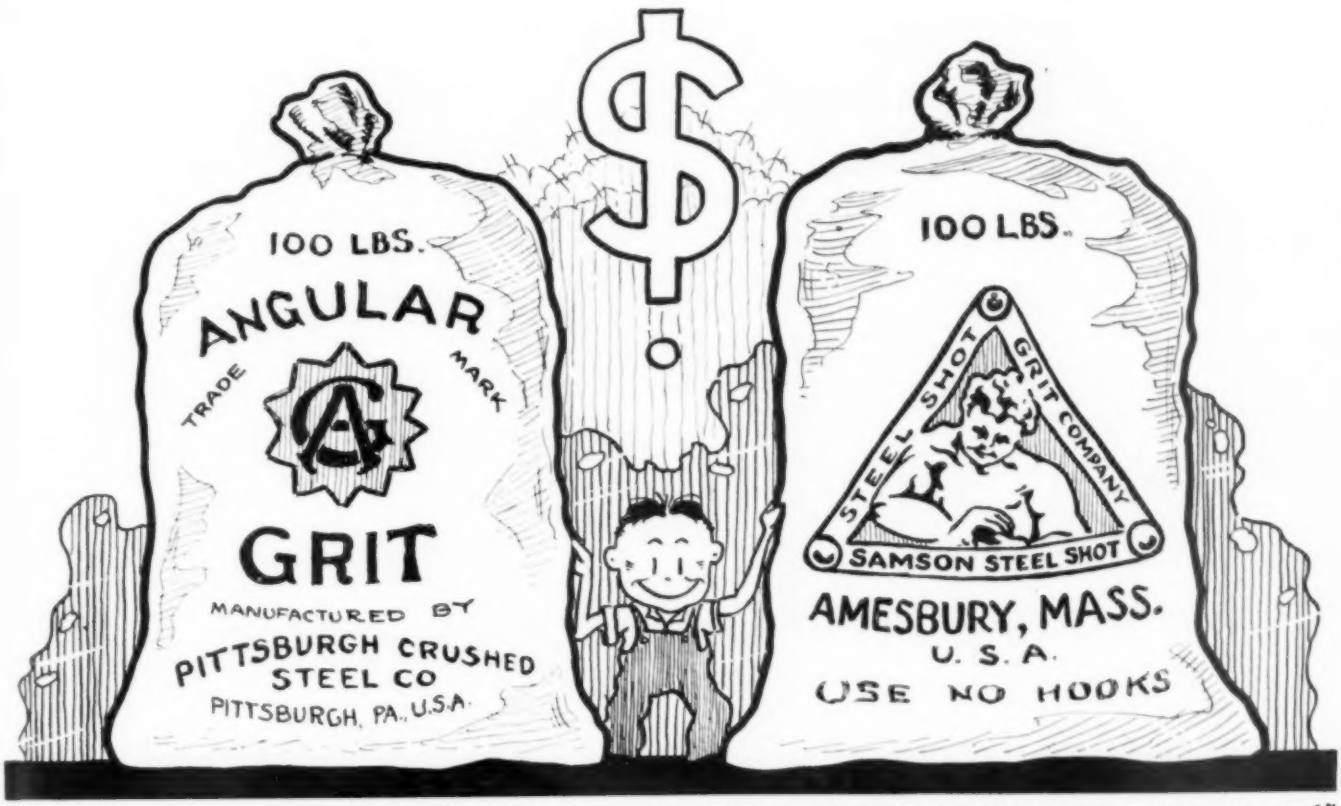
Steel Abrasives



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Fuse Iron to Spinning Shell

(*Concluded from page* 42)

at all times ordinarily is sufficient to hold the jaws against the chuck housing with a margin of safety, an additional safety measure in the form of a mechanical locking device is provided.

The locking device consists of a yoke with rollers on fingers which press on a collar formed by the ball bearing coupling mentioned previously. The yoke is linked to an actuating lever in such a manner as to preclude possibility of the jaws being opened until the lever is operated. Consequently, even if the operator should release the pressure on the piston, the chuck jaws cannot open until the mechanical lock is released. A solenoid brake is attached to the chuck housing shaft so that when the driving motor is stopped the rotation of the chuck ceases automatically in about 10 seconds.

Has Many Safety Features

At this point it may be well to call attention to numerous other safety features incorporated in the casting machines and the turntable mechanisms to prevent accident. Mention previously has been made that the oil pump is chain driven; the chain is enclosed in a case. Cases also are placed over the exposed portions of the chain drives connecting motors and housing shafts on centrifugal casting machines.

Safety hoods are built over the chucks and while not shown in Fig. 7, due to removal to show more detail in the illustrations, safety doors are attached to the hoods to prevent any possibility of metal splashing out during the pouring of the iron into the rotating drums. The oil line which operates under pressure has several safety devices. These include a safety release for excess pressure, a glass gage to show the amount of oil in the tank, indicating gage to show the pressure, and a gravity tell-tale to check the glass sight gage. It is almost needless to mention that all motors have safety cut-out switches to prevent operation during repairs, etc.

Since mechanical limitations regulate the minimum and maximum size of drums that any set of jaws will properly grip, it is necessary to provide several sizes of chuck units. The chuck jaw shafts each will accommodate drums that vary 3 inches in diameter and there are three sizes of chuck housing. The smallest drum made at present is 9 inches in diameter, and the largest (for trucks) is 18 inches in diameter. In all, 12 different sizes are manufactured including the two diameters mentioned. Consequently, three different sizes of machines are used. One takes drums from 9 to 12 inches in diameter, another takes those from 12 to 15 inches in diameter, and the third size from 15 to 18 inches.

Pouring basins are mounted in the safety doors on a single end bearing which is protected from the splash of molten metal. A definite quantity of metal which varies with size

Fig. 12—Sectional views of the steel drum before lining, the lined drum, and the lined drum with the backing plate welded on

of the drum must be poured each time, and this is accomplished simply.

Ladles are semicylindrical in form and are about 8 inches long and 3 inches deep. The lip is 4 inches long and at the left side; it is formed by slightly lowering the side at that point. A flow-off is arranged at the right front end of the pouring ladle, outside of the door. An adjustable stop beneath the flow-off permits accurate control of the metal in the basin as raising the stop increases the capacity and lowering the stop reduces the capacity.

While at present the pouring basins are mounted in the safety doors, which necessitates one for each machine, a device has been designed by which any number of different sized drums may be poured in rotation without delay. The device will be mounted on a section of circular track and be equipped with dogs that will make a positive engagement with the turntable at the vertical center of each casting machine. It will contain only one ladle similar in design to those described.

Each casting unit is operated by seven men whose duties are as follow: Two men carry the iron from the electric furnace and fill the pouring basins. One man turns the handles on the basins emptying the contents into the chucked steel rings. One man removes the hot lined drums from the centrifugal casting machines and hangs them on the lower hooks of the conveyor chain. Another man cleans out the chucks of the casting units.

The cleaning operation is necessitated by the fact that the preheating of the drum, and the hot metal poured in, cause the formation of a fairly heavy scale on the exterior of the shell.

Iron Fuses To Steel

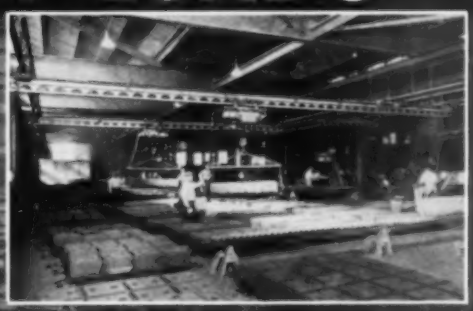
As mentioned previously, the feature of the process is the actual fusion between the steel drum and the cast-in lining. This is illustrated clearly in Fig. 11 showing a magnified cross section of the line of fusion from a finished drum. The granular portion at the bottom of the illustration is part of the cast-in lining. The dark line just above this is the line of fusion while the darker portion immediately above indicates the migration of carbon from the cast iron lining into the steel of the drum.

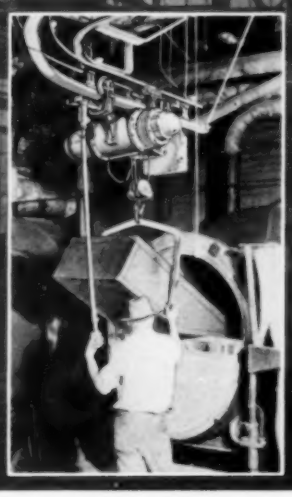
Fig. 12 shows three different sectional views to illustrate the process. At the top is shown a section of the steel drum before it is lined. Just below is a section of a drum that has been lined, and this also shows the bond between the steel drum and the lining. The lower illustration is a half section of the final drum containing the back plate.

The lined drums are shipped to the Motor Wheel Corp., Lansing, Mich., where they are finished in the final form. Each unit makes two brake drums when it is cut apart between the two beads. After the cutting operation, the drum linings are given roughing and finishing cuts, and then the back plate is welded on by a special method. The method, called projection welding, was developed by the Motor Wheel Corp. and gives 12 points of fusion between the back and the inner flange of the drum. After the back plate is welded on, the lining is ground to size ready for shipment.

This is the second of a series of three articles describing the manufacture of cast iron lined brake drums at the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich. The first article appeared in the March 1 issue and the third will appear in an early issue.—The Editors.

MECHANICAL MOVING OF ALL FOUNDRY LOADS





Whether these loads are sand, pig, coke, flasks, molds or castings—even for pouring and at the shakeout there is a Tramrail method and Tramrail equipment to do one or all these jobs. The Tramrail man will show you how he has helped others reduce costs and increase production.

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Baltimore, Md.	Chattanooga, Tenn.	Detroit, Mich.	Hagerstown, Md.	Milwaukee, Wis.	Nutley, N. J.	San Francisco, Calif.	Trenton, N. J.
Birmingham, Ala.	Chicago, Ill.	Duluth, Minn.	Indianapolis, Ind.	Minneapolis, Minn.	Peoria, Ill.	Seattle, Wash.	Tulsa, Okla.
Boston, Mass.	Cincinnati, Ohio	Easton, Pa.	Johnstown, Pa.	Mobile, Ala.	Philadelphia, Pa.	Sheboygan, Wis.	Worcester, Mass.
Brooklyn, N. Y.	Cleveland, Ohio	East St. Louis, Ill.	Joliet, Ill. (See Rockford)	Muskegon, Mich.	Pittsburgh, Pa.	South Bend, Ind.	York, Pa.
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				Newark, N. J	Providence, R. I.		

CLEVELAND HAND OR ELECTRIC TRAMRAIL

Design and Foundry Practice

(*Continued from Page 47*)

the part of the designer of castings, is a most important requisite. The foundryman not only must be heard and heeded, but often must be tempted to discuss his ideals. Perhaps a small modification might permit the development of new foundry practice. Such a practice may be awaiting just such an opportunity. The author knows of no better example of this than the recent practice of the Chevrolet foundry at Saginaw, Mich.

In the accompanying illustration, *a* indicates a casting used as a clutch housing. Such parts have been used in the industry for many years. At Chevrolet this design of clutch housing was preceded by a design as shown in *b*. The casting portion of the *b* construction is obviously a simple open housing easily completely molded with green sand without the aid of any dry-sand cores. In fact, the construction is so simple that in this particular case two of these pieces were cast in one mold.

When the construction was changed, it made necessary the use of a housing as at *a*. The question of cost immediately entered, since this housing was not suited to the casting of two pieces to the mold, and neither was it suited to complete green-sanding. Precedent dictated that the inside should be dry-sand cored. However the Saginaw foundry thought differently, and advised the engineering department that if certain principles were adhered to they could completely mold this casting in green sand. Therefore the design as shown was evolved—not all at once, but gradually, small changes being made continually as problem after problem confronted.

Making the Mold

The inner mold of this piece was made of a special sand under fairly high compression, and is fitted into place within the flask without being removed from the molding machine on which it is made. The flask containing the impression of the inner back flange is then put in place, and the mold is ready for pouring. Note the direction of the various contours, the sharp corners representing the face of the mold. All of this detail was necessary to make this molding process a success.

Due to the fact that the green-sand core under these circumstances is machine-located, the castings obtained by this process have been accurate and highly satisfactory. The price per pound of this casting undoubtedly was lowered considerably, due to the successful development of that method of manufacture.

In spite of the foregoing, it is well to bear in mind the overingenious foundryman, who will undertake to make anything. This type of individual is just as troublesome as the individual who will not co-operate. He permits his enthusiasm to carry him into the realms of impracticability, resulting in hazards for himself and unsatisfactory final cost to his customers. Designers do not realize that actual disaster may follow ill-considered designs of castings.

True Meaning of Bulk

Bulk to the designer may mean only the total size and weight of a given casting. The true bulk is the overall size of the flask necessary to make that casting. If the general dimensions of the casting are such as to require a considerable amount of waste sand, the molding equipment must be larger and therefore slower than necessary.

The principle of flask bulk should be borne in mind with every type of casting. Sometimes a projecting boss or point may require 2 inches or so additional flask, placing molding of the casting just outside the capabilities of a lighter and faster machine, thus increasing the cost burden of the final product.

Wall thickness is the haven for the designer who wishes to reduce weight; yet actually this is the one place where weight cannot be reduced unless the walls prior to change were thicker than good practice would dictate. Light walls breed every known type of foundry loss, and during the process of manufacturing quite often give trouble in handling. Further than this, light walls are the source of resonance under operation.

It has been said many times that "the more cast iron, the less brains," but it is obviously better to have 110 pounds of cast iron at 4 cents a pound than to have 100 pounds of cast iron at 5 cents a pound. The 10 pounds eliminated might be something for the engineer to be proud of, but it is nothing that the engineer can offer his customers with any degree of assurance that the customer will obtain more result for the money he is expending for the product.

If weight is to be eliminated, it must be done by shortening walls and eliminating parts; in other words, by designing less weight into the product, using care that structure has not been impaired and that the machine shop has been interfered with in no way.

There is no casting in use today in any industry wherein walls have a more important function than in the cylinder and crankcase unit casting as used in the automotive industry. In this instance the walls are not used to cover space, but have the most important structural functions, and these walls must be thick enough to answer the purpose. They must be thick enough to be easily cast and thick enough to stand for rough handling of cleaning and fabricating.

Design Governs Cleaning

The designer seldom feels that it is within his scope to aid with the matter of producing clean castings. He feels that this is the business of the foundry, and if the castings are not clean the foundry is at fault. There is no doubt that good foundry practice goes far in insuring clean castings; nevertheless, this ideal could be more easily attained if the designer would co-operate with the foundry in the matter. The foundry gives considerable thought in the method of molding to enhance this point.

Dirt has a tendency to float upward with the iron; therefore the most important part of the cylinder block is usually at the bottom of the mold when the casting is being poured. The dirt rises to an unimportant surface which is later machined, and the difficulty from dirt is more or less mitigated.

However, if core walls are very thin and small projections of sand are permitted to exist, there is al-

Benefit To All

A SOUND engineering program demands correlation of design and foundry practice. Not only must the designer understand the broad principles underlying in general the casting of metals, but the individual foundry practices must be borne in mind. The fact that proper consideration of the mutual problems and the elimination of foundry difficulties will eliminate trouble for the ultimate consumer, and therefore build good will and increased business, makes it imperative that both foundryman and designers be interested in the proper co-operation. This article is abstracted from a paper recently presented before a joint meeting of the Philadelphia Foundrymen's association and members of the American Foundrymen's association in the Philadelphia district. The author is research engineer, Chevrolet Motor Co.

ways the possibility that such spots will easily wash away and the sand find a resting place in a critical location, causing the costliest kind of scrap. A cylinder block, for instance, might be almost completely machined before it is found that one of the bore walls is loaded with sand.

In considering sand cores and green-sand impressions, one should visualize a torrent of boiling iron rushing through this mold, which torrent has weight and therefore pressure, sufficient to break off corners and projections. One should consider where cores are thin and that there is molten iron on both sides of this thin piece of sand, and therefore there is a possibility of burning through. This may come in a spot not easily detected until the casting has been manufactured and delivered into the hands of a customer, who will be constantly annoyed by the recurrence of, perhaps, heating troubles that will baffle even a willing service station.

Small water-jacket core holes may not appear small on the design, but when the designer considers the fact that supporting wires may be at the center of these small cores, then he will realize that his space is indeed small. The fundamental to bear in mind is that the size of the core must always be such as to insure the designer that space will always exist.

Driers for the Sand

In core making itself, the designer must realize that a dry-sand core, though in itself capable of sustaining its own weight without bending, is baked into this condition, and before baking it is a loose, soft, oily pile of sand. Core-sand mixtures are such as to permit almost unbelievable overhanging of the sand. Nevertheless, there are limits to which wet core sand can be piled up and carried from bench to oven. An obviously impossible design to produce and carry around unsupported would be an hour glass. Evidently the narrow center neck in that design cannot support the upper body of sand.

Automotive foundries are asked to make cores of this type every day, and do so. However, it requires additional equipment in the form of driers, which are usually castings with the necessary impressions that are left in the wet sand until it is baked and hard enough to permit withdrawal. Driers are a necessary evil and can never be considered otherwise, and wherever possible the efforts of the designer and the foundryman should be directed toward their elimination.

Mobility for change has become an industrial necessity. All large organizations have learned that it is necessary that they be able to follow the trend by changes as quickly and as readily as possible.

With a casting which is being produced in large quantities, necessitating a considerable number of driers, engineering changes become tremendously expensive, and even minor changes become important.

Recently a minor change was made in the water jacket of a cylinder head. The changes in the pattern equipment were simple enough and not expensive. However, this simple change scrapped the driers used in this equipment, and this necessitated an expense of $25,000.

Fins Are Troublesome

One of the most troublesome by-products of the foundry is the fin, particularly when these fins locate themselves in critical water passages, obstructing circulation. There is little that a designer can do to obviate this nuisance, with the exception of providing ample space so that fins may not bridge across. For the elimination of this evil the designer must rely mostly upon the skill and knowledge of his foundry associates.

To obtain the fullest benefits of design-foundry co-operation, it is first necessary to overcome engineering impatience. Too often an engineer who has given every possible consideration to his foundry problems in his design considers his job done. He immediately hounds the foundry for sample castings overnight. These castings are quickly machined and converted into an experimental unit for development work.

This is a great mistake. First, the foundryman has not been given sufficient time to review the feasibility of the suggestions that they may wish to have incorporated in the casting. Further, they have had no opportunity to check even near-production methods for obtaining the casting. If the casting incorporates practice that is new to the particular foundry, they have not gained any experience that may serve at a later date when they are called on to determine how the product can be produced profitably.

It is important that the foundry be given opportunity to make a sufficient number of castings. This permits them to determine its perculiarities, so that castings submitted to the experimental department at least represent their best judgment. These castings should not be machined, but should be cut up, and the sections carefully analyzed. In this way the engineers can determine whether wall thicknesses are as desired in their various locations and whether the core space and the internal contours are what they really expected.

Often such analysis brings out the fact that cores have shifted. This may be due to methods adopted for making the castings. Perhaps it may be due to faulty design of patterns or core boxes, or an important foundry fundamental may have been overlooked by both the engineer and the foundryman.

A careful going-over of such castings by the engineer and the foundryman together will bring the engineer nearer to the foundry ideals and create a respect in the foundryman's mind for engineering ideals. When a casting is cut up and found to be perfect in every way, a duplicate of this casting can be machined, with some assurance that the results obtained therefrom will represent the future product.

In spite of the greatest care on the part of both engineer and foundryman, cost barnacles are bound to be found clinging to the ship of progress of castings. These cost barnacles are created by the things that have been overlooked and by changes made during the productive period. Unfortunately, a new crop of cost barnacles will find their way into the new product during its productive period. For that reason alone, the foundry is entitled to be rid of the old difficulties.

A most healthy practice for any engineering organization is to go through the foundry practice of the past product, isolating the various annoyances met with during the year and carefully eliminating them from the new product.

True progress can be measured only by tangible results that can be handed to the customer in the form of freedom from difficulty, increased life, quietness, or smoothness.

The foundryman and the engineer are equally interested in the final results of their joint product. Alone their scope is limited; united their progress will be continuous.

New Jersey Group Plans Annual Meeting

Faith in the future of the foundry, one of the great basic industries, was expressed by Pat Dwyer, engineering editor THE FOUNDRY, at a dinner meeting of the New Jersey Foundrymen's association held in the Downtown club, Newark, N. J., Wednesday evening March 23. Several suggestions were presented at the meeting for a program to cover the next or annual meeting May 25 when the officers for the following year are to be elected. Final choice favored an open forum on practical foundry problems, to be followed by theatrical entertainment. President W. H. Mantz, Atlas Foundry Co., Irvington, N. J., appointed Robert Moore, Flockhart Foundry Co., to lead the discussion at the May 25 meeting.

A. S. T. M. Holds Meetings in Cleveland

Approximately 400 members of the American Society for Testing Materials were present at the annual spring group meeting held in Cleveland from March 7 to 11 at the Hotel Cleveland. Committee sessions were held in the morning, afternoon and evening of each day with the exception of Wednesday evening when the regional meeting dinner was held.

Twenty main committee meetings were held, and the section and subcommittees increased the total number of meetings during the five days to 100. The subcommittee on valves, flanges and fittings for high temperature service of committee A-1 on steel considered materials for use at temperatures above 750 degrees Fahr. (400 degrees Cent.). The present standard specifications for castings, pipe flanges and fittings, pipe and bolting materials contemplated temperatures up to 750 degrees Fahr.

Committee A-3 on cast iron has realized the need for classification of types of cast iron and the development of specifications for those classes. During the past year subcommittee VI on general castings was organized to carry on the work. It has suggested a set of classifications which have been approved by the main committee but additional data are required before specifications can be developed.

The subcommittee on cast iron culvert pipe has developed tentative specifications for cast iron culvert pipe which have been approved by committee A-3, and will be presented to the society for action. Subcommittee XV has been engaged for the past two years in the investigation of cast iron impact testing, and several thousand tests have been made. The data are nearly complete, and it is expected that a report will be submitted in the near future.

Committee on the fatigue of metals now is engaged in preparing summaries of present-day knowledge of corrosion-fatigue and of the significance of fatigue to designers and users of structures and machines. Committee E-4 on metallography has decided to revise and combine into one standard the two existing methods of metallographic testing of iron and steel, and of nonferrous metals and alloys. Committee B-5 on copper and copper alloys has approved minor modifications in the tentative specifications for copper-base alloys in ingot form for sand castings, and those for sand castings of the alloy 80 per cent copper; 10 per cent tin, and 10 per cent lead which will be recommended to the society for adoption.

Three new subcommittees were formed by committee B-7 on light metals and alloys to advance the work in that field. The newly formed committees will be responsible for a study of proper test bars for light metals; a study of the determination of the electrolytic properties of light metals, the collection, correlation and dissemination of available engineering data on the physical and mechanical properties of light metals and alloys, and corrosion-resistance properties and protection measures.

Steel Founders Will Meet in New York

Spring meeting of the Steel Founders' Society of America Inc., will be held at the Roosevelt hotel, New York, Wednesday, May 18. G. R. Casey, vice president, Treadwell Engineering Co., Easton, Pa., and vice president of the society's Eastern division, will preside.

The morning session will be devoted to reports of individual members on business conditions, the report of the managing director, remarks by Arthur Simonson, president of the society, and discussions on "Destructive Buying—Deflationary Selling," led by Clarence Tolan Jr., Dodge Steel Co., Philadelphia and John E. Galvin, Ohio Steel Foundry, Lima, O. At the noon luncheon, Robert Arthur Elwood, pastor, the Boardwalk church, Atlantic City, N. J., will talk.

At the afternoon session Clarence B. Bartlett, industrial analyst, Milwaukee, will speak on "The Cost of Dust in the Steel Foundry." Following the general session, meetings will be held by the joint committee composed of the standing cost committee and the special committee of 5 appointed by the president for the revision of operating data reports, and a meeting of the joint committee composed of the technical research committee and the special committee on steel castings brochure.

A meeting of the heat corrosion resistant alloy foundries division will be held on Thursday at the office of the Steel Founders' society in the Graybar building. W. B. Sullivan, Michiana Products Corp., Michigan City, Ind., is chairman of that division.

Awards Prizes

The annual competition among apprentices in the various departments of the Falk Corp., Milwaukee, has resulted in awarding subscriptions to THE FOUNDRY to the following: Frank Demski and Raymond Szmania, foundry prize winners, and William Zuehlsdorf and Roy Fitzgerald, pattern shop prize winners. The Falk Corp. apprenticeship work is under direction of C. J. Freund as supervisor.

New Organization Will Advance Science

An international organization recently has been formed for general advancement and practical development of all branches of science, and to promote a better understanding of the interrelationship of the different specialized branches. Prof. H. W. Blood Ryan, director of research, College of Pestology, London, England, is president of the organization which is called the Faculty of Sciences with offices at 29 New Oxford street, London. A research laboratory has been established at 233 Pentonville road, London. A. Warde Allen is secretary.

Valve Dimensions Are Given in Standard

A proposed standard giving center-to-face dimensions for wedge gate, globe and angle valves has been released for general criticism and comment and may be borrowed from the American Standards association, 29 West Thirty-ninth street, New York, by any one interested. The proposed standard covers wedge gate valves in sizes from 1 to 24 inches outside diameter (cast iron, for 125 and 250-pound steam pressure, and steel, for steam pressures of 150, 300, 400, 600, 900, and 1500 pounds; and globe and angle valves in sizes from ½ to 8 inches (cast iron for 250 pounds steam pressure, and steel for steam pressures of 300, 400, 600, 900 and 1500 pounds.)

February Steel Castings Output Gains

Production of steel castings in February, according to a recent report of the department of commerce, totaled 18,755 tons as compared with 18,456 tons in January. Orders for the month reached 17,015 tons, a decline of 300 tons over the previous month.

Foundries Listed On Ohio Safety Program

An All-Ohio safety congress and exhibit will be held at the Neil house, Columbus, O., April 19, 20, 21, under the auspices of the Industrial Commission of Ohio. The sectional meeting on foundries will be held Wednesday morning, April 20, with J. W. Beal, insurance commissioner, Ohio Steel Foundry Co., Lima, O., as chairman. The papers to be presented include "Accident Statistics Covering

(*Concluded on Page* 92)

BY WAY OF EVIDENCE— THERE IS THIS ROLL GRINDING JOB

IT is the overall grinding of hard alloy iron rolls 18 inches in diameter, 8 feet long, with 11 inch diameter necks on a Cincinnati 24″ x 120″ Roll Grinder.

The job is being done most satisfactorily with the improved Carborundum Brand Redmanol Roll Grinding Wheel, removing $\frac{1}{16}$″ stock and holding to within a tolerance of .001 inch.

This improved wheel not only cuts fast and clean, giving a finish that meets all requirements, but on this Cincinnati Grinder, aided by the fine performance of the wheel, the grinding time has been reduced to 10 hours as against 25 hours on the old set-up.

Speed of cut, economical wheel life, perfection of finish—plus greater production—these are again evidenced through the use of the improved

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(*Concluded from Page* 90)

Ohio Foundries," submitted by the state division of safety and hygiene; "The Safety Drive in Ohio Foundries," by Robert Hoierman, secretary, Ohio Foundries association, Cleveland; "The Requirements for Safe Foundry Operations," by William M. Marr, foundry superintendent, Ohio Brass Co., Mansfield, O.; "Occupational Diseases in Ohio Foundries," by Dr. Carey P. McCord, medical director, Industrial Health Conservancy Laboratories, Cincinnati.

Hold Foundry Conference At Seattle

A conference on foundry technology was held at the University of Washington, Seattle, on March 2, under the auspices of the department of engineering shops in co-operation with the Washington Foundrymen's club and the American Foundrymen's association. Approximately 200 foundrymen in the territory from Vancouver, B. C., to Portland, Oreg., attended and comments indicated that the conference was exceptionally successful.

The technical session opened at two o'clock with W. R. Thompkins, president, Western Foundry Sand Co., Seattle, as chairman. Harry W. Dietert, Harry W. Dietert Co., Detroit, presented an illustrated talk on foundry sand control and Albert E. Greene, president, Greene Electric Furnace Co., Seattle, spoke on furnace melting methods. Considerable discussion followed.

A foundry sand testing demonstration was held in the engineering shop building between 4 and 5:30 p.m. and during the following hour, foundry operations were illustrated in motion pictures with E. O. Eastwood, professor of mechanical engineering, college of engineering, University of Washington, as chairman. The pictures shown included the operation of the powdered coal melting furnace of the Whiting Corp., Harvey, Ill., and films of the Beardsley & Piper Co., Chicago, showing the Nash Motor Corp. foundry and the Nordberg Mfg. Co. foundry in operation.

An informal dinner was held in the evening with Gilbert S. Schaller, associate professor of shop engineering, college of engineering, University of Washington, as toastmaster. R. G. Tyler, dean, college of engineering, welcomed the group and Frank W. McKenzie, chairman, Washington Foundrymen's clubs conference committee responded. Joseph B. Daniels, professor of mining engineering and metallurgy, college of mines, University of Washington, spoke on the history of iron and steel industry in the Pacific Northwest.

The second technical session was held following the dinner, with Rex L. Alexander, president, Washington Foundrymen's club, as chairman. J. F. Mills, metallurgist, Puget Sound navy yard, Bremerton, Wash., spoke on "Gamma Ray Inspection of Foundry Products" and Harry W. Dietert delivered the second talk, dealing with "Gating Methods."

Directory of Foundry Associations

American Foundrymen's Association
President, E. H. Ballard, General Electric Co., West Lynn, Mass.; executive secretary-treasurer, C. E. Hoyt, 222 West Adams street, Chicago; technical secretary, R. E. Kennedy, 222 West Adams street, Chicago.

Associated Brass Founders of New England
President, George W. Thornburg, Crescent Park Brass Foundry, Waltham, Mass.; secretary, Herbert H. Klein, Pennsylvania Foundry Supply Co., 310 Congress street, Boston. Meetings the fourth Wednesday of each month at the Engineers' club, Boston.

The Buffalo Foundrymen
President, J. McArthur, Washington Iron Works; secretary, W. J. Wark, E. J. Woodison Co., 140 Chandler street. Meetings each month at club rooms, 140 Chandler street.

Central Illinois Foundrymen's Club
President, H. M. Hire, Hire Foundry Co., Peoria, Ill.; secretary, Franklin Whitehead, The Meadows Mfg. Co., Bloomington, Ill.

Chicago Foundrymen's Club
President, L. E. Gilmore, Crane Co., Chicago; secretary, Albert N. Wallin, S. Obermayer Co., 2563 West Eighteenth street. Meetings first Thursday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association
President, Carl S. Neumann, Union Mfg. Co., New Britain, Conn.; secretary, Charles S. Parker, Charles Parker Co., Meriden, Conn. Meetings are on second Friday of each month in various parts of the state.

Connecticut Nonferrous Foundrymen's Association
President, C. H. Blanchard, Reading Steel Casting Co., Pratt & Cady division, Hartford, Conn.; secretary, C. D. Elliott, Wilcox, Crittenden Co. Inc., Middletown, Conn. Meetings held the first Monday of each month at place to be named. Recent meetings have been held at Hotel Garde, New Haven, Conn.

Detroit Foundrymen's Association
President, James L. Mahon, American Car & Foundry Co.; secretary, Neil I. McArthur, Great Lakes Foundry Sand Co., 2100 Penobscott building, Detroit. Meetings third Thursday in each month, except December, June, July and August at Ft. Shelby Hotel.

East Bay Foundrymen's Association
Secretary, O. R. Moller, Electric Steel Foundry Co. Inc., 1328 Second street, Berkeley, Calif.

Electric Steel Founders' Research Group
Director, R. A. Bull, Central Office, 541 Diversey Parkway, Chicago.

Gray Iron Institute
President, A. E. Hageboeck, Frank Foundries Corp., Moline, Ill.; manager, Arthur J. Tuscany, 4300 Euclid avenue, Cleveland.

Malleable Club of Milwaukee
President, Scott Mackay, Univertisy of Wisconsin, Madison, Wis.; secretary, M. A. Harder, Lakeside Malleable Iron Co., Racine, Wis. Meetings second Tuesday of the month at Hotel Blatz, Milwaukee.

Malleable Iron Research Institute
President, E. E. Griest, Chicago Railway Equipment Co., Chicago; secretary, Robert E. Belt, Union Trust building, Cleveland.

Metropolitan Brass Founders' Association
President, William Ember, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary, William E. Paulson, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 2 Park avenue, New York.

New Jersey Foundrymen's Association
President, W. H. Mantz Atlas Foundry Co., Irvington, N. J.; secretary, G. W. Hannay, Barnett Foundry & Machine Co., Irvington, N. J. Meeting called by president. Scheduled meeting dates: Oct. 28, Dec. 2, Jan. 27, 1932, March 23, 1932, May 25, 1932.

New England Foundrymen's Association
President, LeRoy M. Sherwin, Brown & Sharpe Mfg. Co., Providence, R. I.; secretary, Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass. Meetings held the second Wednesday of each month excepting July and August at the Engineers club, 2 Commonwealth avenue, Boston. Outings usually are held in the months mentioned.

Ohio Foundries Association Inc.
President, A. H. Kramer, Advance Foundry Co., Dayton, O.; secretary, Robert Hoierman, 418 Penton building, Cleveland.

Pacific Coast Founders Association
President, Charles J. P. Hoehn, Enterprise Foundry Co., 2902 Nineteenth street, San Francisco; manager, George L. Kennard, 116 New Montgomery street, San Francisco.

Philadelphia Foundrymen's Association
President, J. B. Greenstreet, Olney Foundry Co., Philadelphia; secretary, Earl Sparks, 1623 Sansom street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
President, H. F. Siefert, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; secretary-treasurer, William J. Brant, Wm. J. Brant, Bessemer building, Pittsburgh. Meetings on the third Monday of the month, except in July and August at Fort Pitt hotel.

Quad-City Foundrymen's Association
President, E. A. Bullberg, Union Malleable Iron Works, East Moline, Ill.; secretary-treasurer, J. P. Broaden, Union Malleable Iron Co., East Moline, Ill. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

St. Louis District Foundrymen's Club
President, W. C. Raithel, Century Electric Co., St. Louis; secretary-treasurer, Leo J. Filstead, John C. Kupferle Foundry Co., St. Louis. Meetings the fourth Thursday of the month at 6:30 p. m., at the American Annex hotel, Sixth and Market streets, St. Louis.

Southern Metal Trades Association
President, John S. Schofield, J. S. Schofield's Sons Co., Macon, Ga.; secretary, W. E. Dunn Jr., Hurt building, Atlanta, Ga.

Steel Castings Development Bureau
Research Director, George Batty, 500 Stock Exchange building, Philadelphia.

Steel Founders' Society of America
President, Arthur Simonson, Falk Corp., Milwaukee; managing director, G. P. Rogers, Graybar building, New York.

Tri-City Technical Council
Chairman, C. F. Scherer, Davenport Machine & Foundry Co., Davenport, Iowa; secretary, E. C. Xander, assistant secretary, Tri-City Manufacturers association, Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association
President, William Hoppenjans, The Star Foundry Co., 221 Main avenue, Covington, Ky.; secretary, C. C. Erhart, Chris Erhart Foundry Co., Cincinnati. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association
President, Frederick Christensen, R. R. Howell & Co., Minneapolis; secretary-treasurer, C. E. Langdon, 3849 Lyndale avenue, south, Minneapolis. Meetings third Wednesday of each month at Athletic club.

Washington Foundrymen's Club
President, Rex L. Alexander, Olympic Steel Works, Seattle; secretary, Edward C. Gustin, 3716 Grayson street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks Temple, Fourth avenue and Spring street.

Western Foundrymen's Association
President, H. T. Hornsby, Joplin, Mo.; secretary, E. L. Graham, Acme Foundry & Machine Co., Coffeyville, Kans.

Wisconsin Gray Iron Foundry Group
Secretary, W. F. Bornfleth, Cutler-Hammer Inc., Foundry Division, Milwaukee. Meetings on second Wednesday of each month at Hotel Schroeder, Milwaukee.

Obituary

LAVERNE W. SPRING, 56, chief chemist of Crane Co., Chicago, died March 23. Prior to 1904 he was associated with the Illinois Steel Co., Chicago, and Wolverine Portland Cement Co., Coldwater, Mich., but since that time he has been with Crane Co. in various capacities, being chief chemist and metallurgist since 1914. Mr. Spring in 1932 was awarded the John A. Penton gold medal of the American Foundrymen's association for his contributions to the industry.

John B. McKay, 61, superintendent, Stockton Iron Works, Stockton,

LaVerne W. Spring

Calif., and former Chicago foundry owner died recently.

Carl Irresberger, well-known German authority on foundry practice and author of several articles published in THE FOUNDRY, died recently.

Bernard A. Joyce, 46, former manager of the Hoosier Iron Works and the Kokomo Malleable Iron Works Inc., Kokomo, Ind., died at his home at Kokomo on March 15.

Burrows Sloan, one of the organizers of the General Refractories Co., Philadelphia, and chairman of the board of that company, died recently at his home in Barclay, a suburb of Philadelphia.

Edward F. Ruehwein, 77, partner in Moesta & Ruehrwein Co., manufacturers' agents for iron and steel castings, of Cincinnati, died recently. He had been identified with the company for 25 years and was active in civic affairs.

Emanuel A. Wurster, 71, one of the founders of the Falk Corp., Milwaukee, died March 18 at Omaha, Nebr., where he had made his home following his retirement in 1924. He was secretary and treasurer of the Falk company from its inception until his retirement.

George Stroh, 67, founder and president, Stroh Die Moulded Casting Co., Milwaukee, died March 2 after an illness of a year and a half. He was born in Jordan, N. Y., and went to Milwaukee in 1904 to enter the die casting business, building up one of the largest shops of the kind in the central states.

Hermann Fougner, 55, formerly associated with the American Steel & Foundry Co., Truscon Steel Co., United States Shipping board and Standard Oil Co. of New Jersey, died at New York, recently. He was founder and president of the Fougner Steel Co., which went out of business in 1922.

Henry Ehret, 76 years old, founder and president of the Oakland Foundry at Belleville, Ill., died recently at St. Elizabeth's hospital in that city, following an operation. Mr. Ehret was a pioneer foundryman, and introduced numerous developments in technique and general foundry practice.

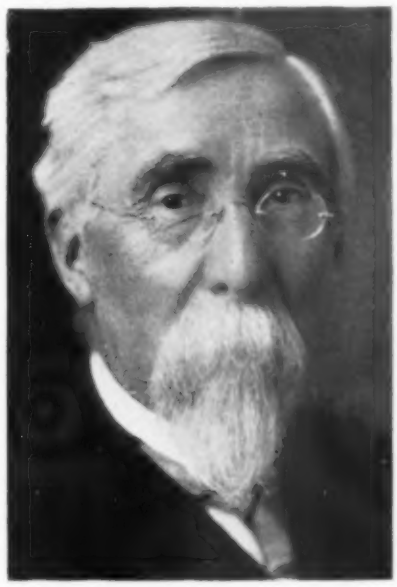
Harold E. Horton, 51, a partner in the Chicago Aluminum Castings Co., Chicago, died March 15 at his home at Riverside, Ill. Mr. Horton, with his brother, George H. Horton, had been connected with the Aluminum Co. of America at New Kensington, Pa., for a number of years and organized the Chicago Aluminum Castings Co. in 1910.

William R. Mathieu, founder of the Mathieu & Sons Foundry Co., Bridgman, Mich., died recently at his home in St. Joseph, Mich. Mr. Mathieu was prominent in St. Joseph as the founder of the old Mathieu foundry on Ann street. Several years ago the industry outgrew its plant and was removed to Bridgman where a large, modern foundry was constructed.

George Nicholson, 62, vice president and assistant general manager of the Vulcan Iron Works, Wilkes-Barre, Pa., died at Wilkes-Barre March 15. He became associated with the Vulcan company at the age of 18 with his father, and brother, Samuel T. Nicholson, who now is president. Mr. Nicholson was president of the Hanover Bank & Trust Co., also president of the Luzerne County Manufacturers' association.

Jacob Kastlin, 76, former vice president and general manager of the Davenport Locomotive Works, Davenport, Iowa, died at Davenport recently. He was born in Switzerland and came to this country in 1876, later going to Burlington, Ill., with the Chicago, Burlington & Quincy railroad. He went with the Davenport Locomotive Works in 1905, becoming vice president and general manager. He was superintendent of the Baldwin Locomotive Works' munitions plant at Philadelphia from 1916 to 1919, but returned to his former position with the Davenport company in 1919, retiring in 1923.

Henry M. Leland, pioneer in the manufacture of automobile and airplane motors, founder of the Leland & Faulconer Mfg. Co., the Cadillac Motor Car Co., and the Lincoln Motor Co., died in Detroit March 25 at the age of 89. He was born in Danville, Vt., Feb. 16, 1843 and learned the trade of machinist in Worcester, Mass. Later he worked as machinist and toolmaker in various shops



Henry M. Leland

and in 1872 entered the employment of Brown & Sharpe, Providence, R. I., where he remained for 18 years. He moved to Detroit in 1890 and as a maker of special machinery played a prominent part in the early development of the automobile. He was counsellor, teacher and friend and his plant was the training school for hundreds of men who afterward attained prominence in the automotive field. He was a member of the American Iron & Steel institute, National Association of Manufacturers, National Founders' association, National Metal Trades association and others.

Dr. Harry Homer Myers, 47, widely known as a lecturer and writer on the human problems in industry, and personnel director, Frigidaire Corp., Dayton, O., died at his home at Alliance on March 19. Dr. Myers was graduated from Western Reserve Medical school, Cleveland, and devoted six years as a practicing physician before entering industrial work. For six years he was associated with the Ohio Brass Co., Mansfield and Shelby, O., and then

followed a similar line of work with the Dayton Malleable Iron Co. in plants located at Dayton, O., and Buffalo. Later he joined the Frigidaire Corp. as personnel director.

Hugh R. Corse, 52, affiliated with the sales department of the Lumen Bearings Co., Buffalo, died recently. Mr. Corse was born at Malden, Mass., in 1880 and was educated in the Massachusetts public schools, and graduated from the Medford high school, Medford, Mass. He first was employed in the manufacture of rubber goods in Connecticut. In 1905 he moved to Detroit, where he engaged in the radiator business, automobile manufacturing and selling mill supplies. In 1910 he joined the sales department of the Lumen Bearing Co., Buffalo, and was connected with that company continuously with the exception of the six years between 1914 and 1920, when he was with the Titanium Bronze Co., Niagara Falls, N. Y.

Percival Chrystie, 63 chairman of the board, Taylor-Wharton Iron & Steel Co., High Bridge, N. J., died at High Bridge on March 28. Mr. Chrystie started work in the company's shops as a boy and progressed through several departments until he was made an inspector. He then went into the sales department and was assigned the work of introducing the use of manganese steel in the Pennsylvania anthracite coal fields. After accomplishing that task he was recalled to the plant and appointed superintendent of the steel foundry. Later he was made secretary and treasurer and then vice president. He held the latter position for 16 years until the death of Knox Taylor, when he was made president. However, he had been in poor health and resigned the presidency in 1919.

Made President of Electric Hoist Makers

William White, Euclid Crane & Hoist Co., Euclid, O., was elected chairman of the Electric Hoist Manufacturers' association, New York, at its annual meeting March 17 at New York. He succeeds D. S. Brisbin, Chisholm-Moore Hoist Corp., Tonawanda, N. Y.

D. B. Patterson, Harnischfeger Sales Corp., Milwaukee, was elected vice chairman of the association.

Equipment Orders Up

Index of foundry equipment orders for February was 27.6 compared with 20.5 in January, according to a recent report of the Foundry Equipment Manufacturers' association. Index of unfilled orders increased from 29.1 in January to 41.3 in February.

Avoiding Pitfalls in Foundry Cost Work

(*Concluded from Page* 37)

ures the actual loss accruing from operations, with the deduction based upon absentee workmen, repairs, etc.

The function of management in the industry is to decide from these established cost facts and prophecies of future business a fair normal and use it in establishing sales prices.

Owing to the wide variation in tonnage per hour produced by different molders in the same period and variations of tonnage caused by the size, and varied intricacy in shapes of castings, it is unsafe to use tonnage as a basis of cost distributions in *any* of the foundry activities except melting and some classes of cleaning.

There is another use for the cost system that is just as important to the profit situation of the foundryman as establishing a sound sales basis, and that is setting up activity standards in every place where there is a possibility of elimination of wasted materials and effort.

In the new order business administration this will be a necessary function of the cost system and the wise foundryman will establish all standards that he can before business approaches normal so his production cost machine will be built, oiled and ready to do its share in earning profits quickly.

New Specifications Will Cover Gray Iron

Definite action to compile new specifications covering general gray iron castings was taken at a meeting of Committee A-3 of the American Society for Testing Materials held in Cleveland during the week of March 7. According to H. Bornstein, chairman of this committee, the advancement and improvements which have been made in the metallurgy of gray iron and the need for more information for designing engineers and manufacturers have brought a new concept of the character of such specifications.

It has been recognized by foundrymen and metallurgists that various classes of gray iron should be established to meet the varied needs and requirements of users. These classifications will not conflict in any manner with definite specifications which have been set up for such specialties as pipe, valves and fittings, etc. With this object in view tensile strength will be considered in relation to corresponding transverse tests and data covering tensile properties in relation to transverse recently compiled by the Gray Iron institute under supervision of its technical director, Oliver Smalley, have been offered to committee A-3 and in conjunction with the findings of the A. S. T. M. committee will be used as a basis for new specifications.

Producers of gray iron castings have felt that existing specifications and tests which reflect only the quality of the iron in the ladle were inadequate. Accordingly, an attempt is being made to present test methods and test bars which will lead to a clear judgment of the qualities of iron in a casting. These factors have been basic in the investigations which have been carried on by various metallurgists and by the Gray Iron institute.

Standard Symbols For Testing Materials

Symbols for mechanics, structural engineering, and testing materials have been approved by the American Standards association as a standard. The standard consists of letter symbols for 69 quantities commonly used in these fields. The symbols were prepared under the sponsorship of the American Association for the Advancement of Science, the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers, and the Society for the Promotion of Engineering Education. Copies of the symbols may be obtained from the American Standards association, 29 West Thirty-ninth street, New York.

Joins Surface Combustion

William B. Cooley, formerly sales manager of the Hevi-Duty Electric Co., Milwaukee, is now engaged in sales activities in the continuous heat-treating division of the Surface Combustion Corp., Toledo. O. Mr. Cooley was graduated from Purdue university in 1917 in electrical engineering and has been associated with metal-working industries since 1918. Prior to his affiliation with the Hevi-Duty company he was connected with the Industrial Electric Furnace Co. and the Westinghouse Electric & Mfg. Co.

Discusses Mixtures

C. Walter Yost, the Midvale Co., Philadelphia, discussed "Calculation of Cupola Mixtures," at the regular meeting of the Philadelphia Foundrymen's association held at the Manufacturers club, Philadelphia, on March 9. Mr. Yost used as the basis of his discussion the committee report of the American Foundrymen's association. J. B. Greenstreet, Olney Foundry Co., Philadelphia, and president of the association, presided.

Shown above is the Spencer Turbo-Compressor in service at the Central Iron Foundry, Detroit. Capacity 10,000 cu. ft.—1 lb. pressure.

IN your search for ways to cut foundry costs, start with the air supply equipment.

Sooner or later your investigations will bring you face to face with the practical—not just theoretical—economy of slow speed, multistage operation—the Spencer Turbo. Slow speed operation brings you lower melting costs and lower operating costs.

... Lower melting costs, because the ample volume of air is so easily controlled, enabling the operator instantly to adjust volume and pressure to meet changing conditions.

... Lower operating costs, because the slow speed 1750 R. P. M. turbo does all the work that high speed blowers can do, but with less effort. Less wear and tear, less vibration, less noise.

The lower cost of slow speed turbo operation begins at the outset. No costly foundation needed, no fussy alignment.

Maintenance is exceptionally low. All clearances are wide. Two over-size Ball Bearings are the only contacts. Rust resisting and corrosion resisting steel construction.

Sizes from 125 to 20,000 cu. ft.—1 to 300 H. P.—8 oz. to 4 lbs.

Our Foundry Bulletin gives the How and Why of lower melting costs. Shall we send it?

THE SPENCER TURBINE CO.
HARTFORD CONNECTICUT

SPENCER
TURBO-COMPRESSORS

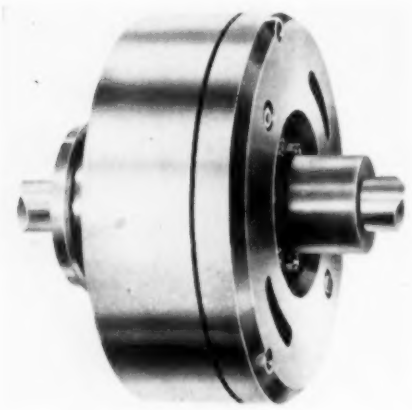
1778

New Equipment

For Foundries

Clutch Is of the Magnetic Friction Type

Dings Magnetic Separator Co., Milwaukee, has developed a magnetic friction-type clutch of small physical dimensions. The unit has contact faces on both sides of a spring disk which are squeezed between the magnet and armature elements when the coil is energized. Theoretically, the power transmission of this clutch is double that of single friction contact face but actually it is of approximately 75 per cent greater torque with the same magnet strength. Provisions are made for adjustment to compensate for wear of contact faces. Light springs on the armature holding bolts serve to expel the armature when coil is de-energized, thus providing ample clearance between the two clutch elements.



A housing completely protects the slip ring brush holder assembly

The clutch is made with and without ball bearings between the hubs of the two clutch members, as installation conditions might require to assure proper alignment.

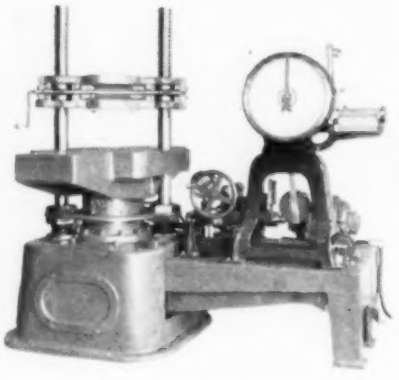
The Dings company also has developed a single spring disk clutch following the same general construction as the unit previously described, but having three friction contact faces with the consequent increase in torque and power transmission. It is the practice of the Dings company to provide a housing over the slip ring brush holder assembly, completely protecting it. The friction wearing surfaces are a hard and tough asbestos compound formed to fit the clutch disk to which they are riveted securely.

Coils are form wound, vacuum pressure impregnated and held in the magnet element from which they are amply insulated. The common clutch installation is to mount the magnet element on the driving shaft and disk element on which only friction contact surfaces are mounted, as the driven member. However, it is feasible to reverse the clutch mounting.

Testing Machine Operates Hydraulically

Toledo Precision Devices Inc., Toledo, O., recently has developed a new testing machine designed for compression, tension and transverse bending tests. The force is applied by a hydraulic press and the device is designed to operate at any desired speed. The force measured is that applied to the test piece alone.

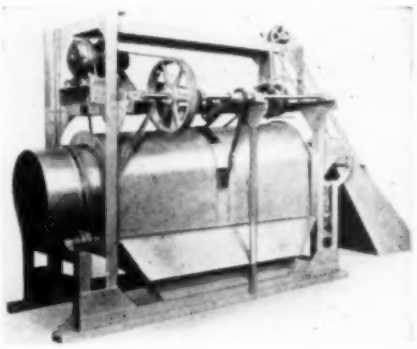
Accurate results are claimed, due to the use of automatic springless pendulum type, counterbalancing mechanism. The device is so designed that friction, oil thickness and temperature do not affect exact results of the machine. Ease of operation is a feature claimed for the machine. The operator can regulate the speed by turning a wheel and observe the pressure applied from the dial. The machine is compact, a complete unit of 200,000 pounds capacity occupying a space 7 x 4 feet.



Machine for compression, tension and transverse bending tests

Barrel Shakes Sand from Castings

A unit for shaking out annealed castings has been developed by N. Ransohoff Inc., Cincinnati. Annealing pots are dumped into a power-operated loading skip which charges a sand shaking barrel, as shown in the accompanying illustration. The barrel rotates at 50 revolutions per minute. All excess sand is removed from the castings as they are revolved in the barrel.



The hood is connected with an exhaust system

The equipment provides for connection of the hood with an exhaust system, the dust being removed through the exhaust and the heavy sand falling to the bottom of the hood and is delivered at the side of the machine. The castings are discharged from the end of the barrel into shop receptacles or into the loading skip of the barrel which is to perform the tumbling operation. It is claimed that the use of this barrel prevents excessive sand being carried to the tumbling barrels and results in a saving of time.

The annual meeting of the American Welding society will be held in the Engineers Societies building, 33 West Thirty-ninth street, New York, on April 27, 28 and 29.

Oil Seal Serves Antifriction Bearings

Aetna Ball Bearing Mfg. Co., Chicago, recently has developed a new oil seal which consists of an outer shell housing the steel cushion, pressure plate and steel retainer. The thermopneumatic seal cushion consists of specially treated cork in which the interstices or air cells are captivated and hermetically sealed. This pneumatic seal cushion automatically expands and contracts laterally with changing temperature of shaft or lubricant, and as a consequence always remains oil tight. The deflector-pressure plate, a specially treated fibre, deflects oil from the seal proper and serves to maintain a constant steady pressure upon the pneumatic cushion and a uniform pressure over the entire periphery of the seal, while relieving it of extraneous internal pressure.

Electric Magnet Has High Lifting Power

A new lifting magnet, suitable for use with crawler type cranes in foundries, scrap yards, warehouses, etc., where the size of the direct current generator must be small and the lifting capacity of the magnet high, recently has been introduced by Cutler-Hammer Inc., 244 North Twelfth street, Milwaukee.

The design of the new magnet is essentially the same as for larger size lifting magnets for heavy duty service manufactured by that company. The magnet case is of high permeability steel with renewable pole shoes of special, wear resisting steel. After winding, the coil is treated by an insulating process which is designed to hold the coils in place permanently and make it hard and rigid, fill the crevices of the magnet interior to make it waterproof and reduce the *hot spot* temperature. That feature it is claimed will result in longer life for the magnet and permit its use for handling hot materials. The weight of the magnet is approximately 1300 pounds and the unit is 30 inches in diameter.

The magnet weighs approximately 1300 pounds

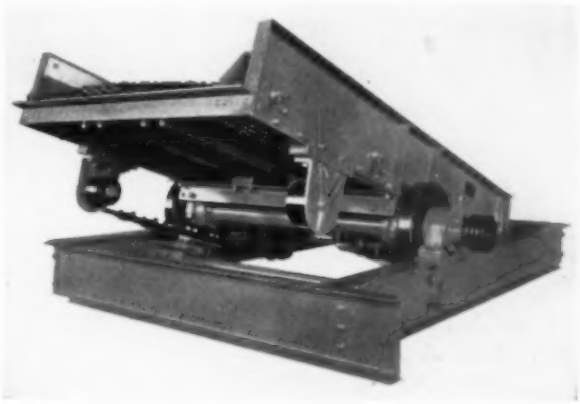
Screen Has Single or Double Deck

Link-Belt Co., Philadelphia, recently has introduced two new types of vibrating screens, one a positive-drive-type, heavy-duty vibrating screen and the other an unbalanced-pulley-type, heavy-duty vibrating screen. In the positive-drive-type screen the amplitude of vibration is fixed at the factory before shipment to suit the work the screen is to do. Any given amplitude will cover a wide range of screening surface openings. The angle of the screen inclination, the speed of operation and the direction of rotation all are readily changed at any time to suit the type of material to be screened. The rotation determines whether the vibrations are with or against the flow of material.

The vibrator is made either with double-deck screen or single screen, the latter being shown in the accompanying illustration. In the double-deck screen, the cloths are placed under tension crosswise by side tension members, which also serve as wearing plates to prevent the material from leaking along the edges. Only the screen cloths need be removed when replacements are required.

The cantilever leaf springs serve to maintain the screen box at a constant angle, being adapted for the circular motion produced by the action of the eccentric-driven positive drive. Oversize self-aligning spherical roller bearings are used.

The unbalanced-pulley-type heavy-duty screen, is available with single or multiple decks for high speed work where the material is of a sticky nature and on close-sizing problems where the screen openings are not large. The total movement, or amplitude of the screen can be varied by the user from zero to about ¼-inch by changing the counterweights in the weight containers. The angle of the screen and the speed and direction of operation also can be changed readily by the user.



The cantilever leaf springs serve to maintain the screen box at a constant angle

The pneumatic grinder weighs 8¾ pounds

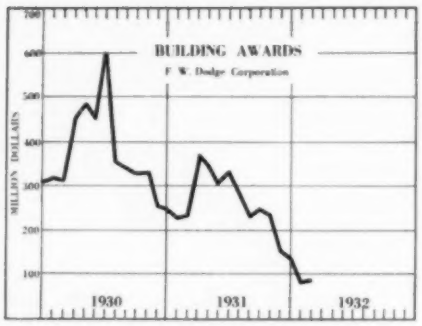
Grinder Operates With Cone Shaped Wheels

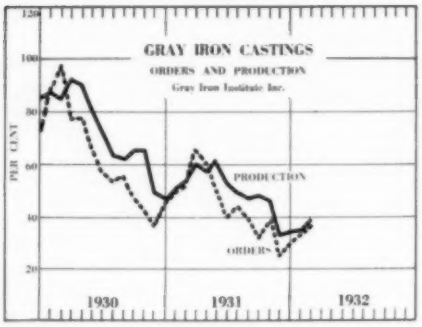
Independent Pneumatic Tool Co., 600 West Jackson boulevard, Chicago, has added a high speed rotary air grinder to its line of pneumatic tools. The new grinder, designed to operate cone shaped grinding wheels, is applicable to foundries and machine shops for cleaning castings of all descriptions and for grinding castings and forgings where the use of the ordinary wheel is not practical.

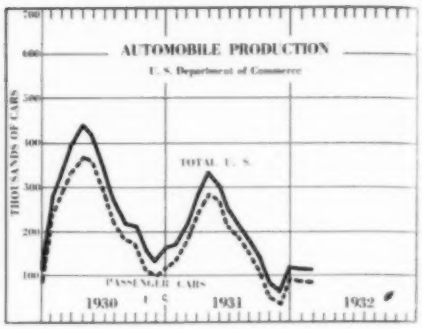
The speed of the grinder is 10,000 revolutions per minute and it will operate cone wheels measuring 2¾-inch outside diameter. The weight of the machine is 8¾ pounds, and length overall is 19¼ inches. The driving collar of the new machine is provided with right thread.

Designs Tip Adaptor

Linde Air Products Co., 30 East Forty-second street, New York, has added a tip adaptor to its line of purox welding apparatus, which can be used to increase the range and usefulness of the welding torch products under that name. The new tip adaptor makes it possible to use a variety of stems and tips, thus enabling the welder, who has only an occasional light welding job, to use correct welding tips for small work.







Foundry Activities

Reflect Industrial Trends

CATSKILL FOUNDRY & MACHINE WORKS, Catskill, N. Y., has changed its name to the Parker Freezer Machine Corp., and will increase in capital from $50,000 to $300,000 for expansion purposes. The change was made to facilitate the manufacture of two new lines, namely Yankee building drains and Parker electric freezer. The company also will continue its general line of foundry and machine shop work.

* * *

Barton Foundry & Specialty Co., 3627 Superior street, Detroit, has been incorporated for $5000.

* * *

J. C. Varvel, Muskego, Wis., plans to establish a brass and aluminum foundry at Sharon, Wis.

* * *

Valley Mould & Iron Corp., Hubbard, O., recently resumed operations after being idle for approximately 2 months.

* * *

Enterprise Machine & Foundry Co., Hattiesburg, Miss., recently was damaged by fire to the extent of $35,000.

* * *

DeSoto Foundry Inc., Mansfield, La., has been incorporated with 1000 shares no par value to manufacture gray iron and steel castings.

* * *

DuBois National Castings Co., DuBois, Pa., has been incorporated with $5000 capital to manufacture castings by P. C. Ake, DuBois.

* * *

Nash Engineering Works Ltd., Prince George, B. C., has started work on the erection of a foundry on Atlin avenue, one story, 25 x 50 feet.

* * *

Canadian Iron Foundries Ltd. plans to build a plant at Three Rivers, Que., for the manufacture of cast iron water pipe and valves.

* * *

Gellman Mfg. Co., Rock Island, Ill., is considering the erection of a one-story foundry at a total cost of $40,000 with equipment.

* * *

Auburn Foundry Inc., Auburn, Ind., has been organized by D. O. Sphinx, Stanley C. Midford and William H. Humbach.

* * *

Great Lakes Mfg. Co., Wyandotte, Mich., recently has been organized by Thomas H. Conway and Louis H. Daily to manufacture nonferrous castings.

* * *

Motor Machinery Casting Co., Detroit, will erect a foundry building on Davison avenue. Angell & Shreve, Detroit, are the architects.

* * *

Gellman Mfg. Co., Rock Island, Ill., A. W. Gellman, manager, plans construction of a foundry at First street and Seventeenth avenue, to cost $50,000.

* * *

Granite City Casting Co., Sixteenth street and Delmar avenue, Granite City, Ill., has been incorporated with $20,000 capital to operate a foundry, by R. W. Griffith, City Hall, Granite City, and associates.

* * *

A. J. Kallsheur Co., 2135 North Cicero avenue, Chicago, has been incorporated with $3000 capital to manufacture brass rollers and die castings, by Muller Bros. Art & Mfg. Co., 2641 West Polk street.

* * *

Karl Mfg. Co., 640 Front avenue, N. W., Grand Rapids, Mich., has been incorporated with 50,000 shares no par value to manufacture castings and implements, by William E. Karl and John Vanderveen, Grand Rapids.

* * *

Benjamin E. Jarvis Co., Newark, N. J., has moved into a new one-story modern building at 74-8 Malvern street, Newark. The company specializes in wood and metal patterns.

* * *

Tonawanda Foundry & Machine Corp., Tonawanda, N. Y., has been organized by George F. Phillips, 80 Chapin Parkway and Homer H. Woods, 196 North street, Buffalo, to manufac-

RAW MATERIAL PRICES
April 6, 1932

Iron	
No. 2 foundry, Valley	15.00
No. 2 Southern, Birmingham	11.00
No. 2 foundry, Chicago	16.50
No. 2 foundry, Buffalo	16.00
Basic, Valley	14.50 to 15.00
Basic, Buffalo	15.50 to 16.00
Malleable, Chicago	16.50
Malleable, Buffalo	16.50
Coke	
Connellsville Beehive Coke	$3.25 to 4.50
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$10.00
Heavy melting steel, Pitts.	10.00 to 10.50
Heavy melting steel, Chicago	6.75 to 7.25
Stove plate, Buffalo	8.50 to 8.75
Stove plate, Chicago	5.75 to 6.25
No. 1 cast, New York	6.00 to 6.25
No. 1 cast, Chicago	7.50 to 8.00
No. 1 cast, Philadelphia	9.50 to 10.00
No. 1 cast, Pittsburgh	9.50 to 10.00
No. 1 cast, Birmingham	8.00 to 9.00
Car wheels, iron, Pittsburgh	10.00 to 10.25
Car wheels, iron, Chicago	7.00 to 7.50
Railroad malleable, Chicago	6.75 to 7.25
Agricultural mal., Chicago	6.50 to 7.00
Malleable, Buffalo	9.00 to 9.50
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	5.50 to 5.75
Straits tin	19.25
Aluminum, No. 12, producers	22.00
Aluminum, No. 12 remelt	8.00 to 9.00
Lead, New York	3.00
Antimony, New York	6.00 to 6.05
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	3.80

ture metal castings and operate machine works.

* * *

Foundry owned by the Citizens National Bank and First National Bank of Lehighton, Pa., and formerly operated by the Lehigh Valley Stove Co., recently was damaged by fire to the extent of $75,000.

* * *

Pattern shops and offices of the old Crawford & McCrimmon Foundry & Machine shops, Brazil, Ind., recently were destroyed by fire. The company has not operated for several years.

* * *

Ogden Machinery Corp., Newark, N. J., has been incorporated with 1000 shares common stock no par value to manufacture machinery and conduct a brass foundry and metal working plant, by Julius Stein, 24 Commerce street, Newark.

* * *

Hunt Spiller Mfg. Corp., 383 Dorchester avenue, South Boston, Mass., manufacturer of gun iron castings, is building a substation for transforming high-tension current for its industrial use, costing $20,000 for building and equipment.

* * *

Novo Engine Co., Lansing, Mich., which operates a large gray iron foundry, recently has increased production in its foundry department. New business has come from various manufacturers, necessitating the increasing of castings production schedule of the plant.

* * *

A. C. Williams Co., Ravenna, O., is remodelling its office and building a display room. The old office, which was built in 1847, will remain standing. The company has been operating at 100 per cent of capacity recently.

* * *

Ri-Mold Castings Co., 44 Douglas avenue, Dayton, O., recently has established itself in new quarters. The company, which specializes in matchplates, core boxes and castings, also has enlarged its sand casting department.

* * *

Fire, which originated in the pattern room of the City Foundry Co., St. Louis, recently resulted in damage to building and stock amounting to $60,000. The loss was covered fully by insurance. U. S. Arnold, vice president, reports that the fire has not interrupted production and that the damage is being repaired.

* * *

Shank Foundries Inc., Akron, Ind., G. L. Shank, president, is passing into the control of Mr. Shank, who has contracted to purchase the remaining stock outside his interest. The company has closed a contract for production of a special line which will occupy two-thirds of its capacity for a long period.

* * *

Holland Furnace Co., Holland, Mich., domestic heating equipment, has reopened its plant at Cedar Rapids, Iowa, which had been closed since Nov. 14.

* * *

Anderson Stove Works, Anderson, Ind., is operating full time six days a week and some departments are working overtime to fill orders, according to William Quinn, president.

* * *

Potsdam Foundry & Machine Shop, Potsdam, N. Y., recently resumed operation of its machine shop after being idle for two years, and in the future will place its foundry in operation. The company, which was founded in 1821, is being operated by J. L. Nicholson, formerly connected with the Kendall-Lamar Corp., Potsdam.

* * *

Controlling interest in the Eagle Foundry & Machine Co., Muskegon, Mich., has been acquired by the Austin Machinery Corp. The Eagle foundry which was organized 12 years ago, will continue its corporate identity. The new officers are W. E. Jeanot, chairman of the board; Otto A. Seyferth, president; F. A. Backstrom, vice president and general manager; Walter Strate, treasurer; and Russell Spring, secretary of the company.

* * *

American Steel Foundries, formerly the Galesburg Malleable Co., Galesburg, Ill., was reported operating on a 5½-day schedule at the middle of March, the first time the plant operated a full week in the past 21 months. C. H. Bossong is local manager of the company.

* * *

Electric Auto-Lite Co., Toledo, O., has acquired a substantial minority interest in the Mueller Brass Co., Port Huron, Mich. Officers of the Mueller Co. are as follows: President and general manager, O. B. Mueller; executive vice president and secretary, Fred L. Riggin; vice president in charge of production, B. F. Mueller; treasurer, R. W. Peden; and assistant secretary, Zelda Dunkel.

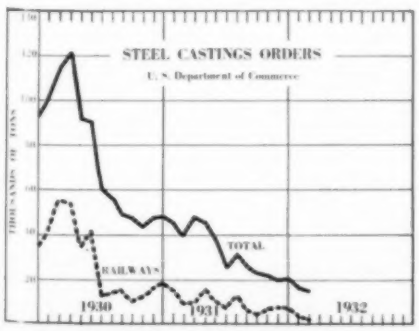
* * *

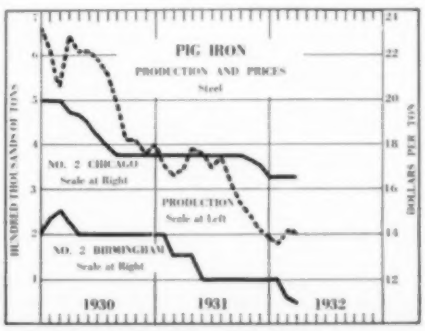
Lumen Bearing Co., Buffalo, recently purchased the plant, equipment, supplies, patents, etc., of the Buffalo Bronze Die Cast Corp., Buffalo. The latter company for several years has produced bronze and brass castings and the plant purchased by the Lumen Bearing Co. comprises a foundry with a large amount of special equipment, a machine shop with a wide variety of machine tools and special equipment, and a well-equipped core room and cleaning and snagging departments. Much of the equipment was designed especially for the production of special castings, such as certain types of worm gears. Lumen Bearing Co. was incorporated under the laws of New York with $500,000 capitalization in 1901, the organization being made up of men of wide foundry experience, many of whom have been with the company since its inception.

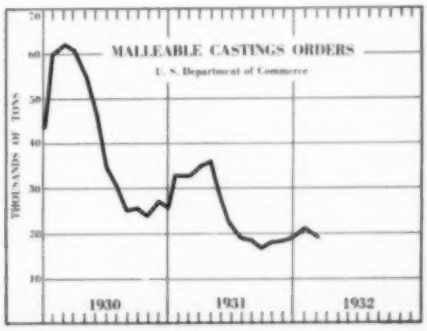
* * *

Co-incident with the completion of substantial improvements, the Canton, O., cast-iron roll foundry of the United Engineering & Foundry Co., Pittsburgh, observed its twenty-fifth birthday with the casting of the 10,000th furnace heat and its 110,000th roll. Since the first roll was cast in March, 1907, the plant has enjoyed a record of having produced rolls varying from those with 6-inch face for the rolling of silver and requiring 100 pounds of hot metal to those 44½ inches in diameter and 160 inches long for plate mills and requiring 120,000 pounds of hot metal.

The plant is devoted exclusively to the production of iron and iron alloy rolls for rolling mill purposes. The original plant capacity was 400 tons per month, with equipment consisting of four belt-driven roll lathes, while today the capacity is of 4000 tons per month, with lathe and grinding equipment to correspond, making the plant the largest roll foundry in the world.







DIAMOND SAND BLAST

DIAMOND

LIKE the diamonds from which we take the brand name, Diamond Sand Blast Sand is clean, sharp, fast cutting. Ideal for all manner of sand blasting, being especially prepared for this kind of work.

Call on us to assist you in solving your sand blast problems.

Sand Blast Sand

FOR FAST CLEANING AND FINE FINISH standardize on Diamond Sand Blast Sand. It gives results that are impossible to duplicate with other forms of abrasives, and besides, it is the most economical cleaning agent you can employ.

WASHED, DRIED AND SCREENED SPECIAL SANDS FOR STEEL MOULDING, FURNACE BOTTOMS, CORES, OPENERS,—AND SILICA FLOUR

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AMERICAN Abrasive Blast

WHATEVER your needs may be, you can find in the American Line a type which will satisfactorily and economically handle your work.

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The American Foundry Equipment Company

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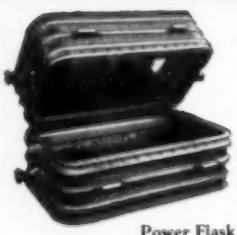
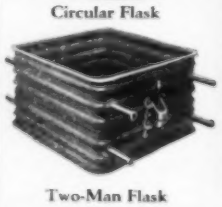
TRUSCON The Most Complete Line



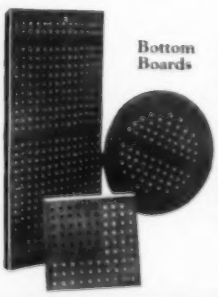
Power Flask

Barring Flask

Circular Flask



Two-Man Flask



Bottom Boards

Core Rack

TRUSCON
ALLOY-STEEL
FOUNDRY FLASKS
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Available in all types and sizes from light bench units to large power flasks. Easy to handle and designed to withstand the abuse of continual service. Write for catalog describing complete line of Truscon Flasks and Foundry Accessories.

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